U.S. STEEL HOMESTEAD WORKS
Along the Monongahela River
Homestead
Allegheny County
Pennsylvania

HAER No. PA-200

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Historic American Engineering Record
National Park Service
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HISTORIC AMERICAN ENGINEERING RECORD

U.S. STEEL HOMESTEAD WORKS

HAER No. PA-200

LOCATION: The U.S. Steel Homestead Works is located on the left bank of the Monongahela River, in Homestead, Allegheny County, Pennsylvania.

DATES OF CONSTRUCTION: 1879, 1883, 1895-99, 1917, 1926, 1941-44

PRESENT OWNER: Park Corporation, Cleveland, Ohio

PRESENT USE: Closed 1980s. Many of the structures inventoried in this report were demolished between 1990 and 1993.

SIGNIFICANCE: Established in 1879, Homestead Works is one of six plants (Homestead, Edgar Thomson, Duquesne, Irvin, National and Clairton) which, until the collapse in 1982, comprised U.S. Steel's Mon Valley works. In 1883, Andrew Carnegie acquired the works and transformed Homestead from a Bessemer rail mill to a highly mechanized, fully integrated heavy products mill. Open Hearth No. 1 was the first facility for large scale commercial production of basic open hearth steel in the country. Homestead rivaled all other mills in structural steel production during the late-nineteenth-century. The armor forging plant at Homestead played a central role in the development of American sea power and the American military-industrial complex. Homestead was a leader in the use of machinery such as hydraulic and electric cranes to reduce labor and increase production tonnage.

In 1901, Homestead, along with the rest of Carnegie Steel, was absorbed by the United States Steel Corporation in a consolidation of the steel industry. Expansion to meet the production demands of World War I and World War II generated important periods of change at Homestead. Also, during the 1920s U.S. Steel modernized Homestead's structural mills in an effort to stay competitive with Bethlehem Steel. Postwar technical developments at the Homestead Works included the commercial development of high-strength alloy steel plate. After the Korean War, the forge division tooled up to produce nuclear containment vessels and electric generator shafts. As a group, the structures and steel-making equipment from Homestead Works represented one of the nation's most important steel mills and the Mon Valley's status as the pre-eminent iron and steel center in the United States for much of the nineteenth and twentieth centuries.

PROJECT INFORMATION: The U.S. Steel Homestead Works documentation project is part of a larger multi-year effort to document the historic steel mills of the Monongahela Valley by the Historic American Engineering Record (HAER), a division of the National Park Service, U.S. Department of the Interior, dedicated to documenting historically significant engineering and industrial works in the United States. The Monongahela Valley Recording project was cosponsored in 1989-90 by the Steel Industry Heritage Task Force, Jo H. Debolt, Chair, and in subsequent years by the Steel Industry Heritage Corporation, August Carlino, Executive Director.

Documentation was prepared under the direction of G. Gray Fitzsimons, HAER Historian/Engineer. Formal photography was done by Martin Stupich. Mark Brown served as the project historian. Editors in HAER's Washington office were Dean Herrin, Michael Bennett, and Lisa Pfueller Davidson.

Three additional steel mills were recorded as part of the 1989-90 documentation of historic steel mills in the Monongahela Valley:

U.S. Steel Edgar Thomson Works	HAER No. PA-384
U.S. Steel Duquesne Works	HAER No. PA-115
U.S. Steel National Tube Works	HAER No. PA-380

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*HAER project historian Mark M. Brown published his findings from the Homestead Works research prior to completion and transmittal of the Monongahela Valley steel heritage documentation projects. His article is reproduced here as the overview history with permission from editor Lance Metz of *Canal History and Technology Proceedings*. (Mark M. Brown, "Technology and the Homestead Steel Works," *Canal History and Technology Proceedings* 11 (14 March 1992): 177-232.)

*Note - Corrections: The illustration caption on page nine should be switched with the caption on page fifteen. Also, the beginning of the illustration caption on page twenty-three should read "10,000-12,000 ton forging press."

*A complete table of contents to inventoried structures and a historical summary including a list of significant resources is located at the beginning of Appendix I.

*Originally published by project historian Mark M. Brown as "Technology and the Homestead Steel Works," *Canal History and Technology Proceedings* 11 (14 March 1992): 177-232. Reproduced with permission.

TECHNOLOGY AND THE HOMESTEAD STEEL WORKS: 1879-1945

Mark M. Brown

For a little over one hundred years the Homestead Steel Works and the Carrie Furnaces manufactured a variety of semifinished and finished steel products.[1] The chief products were rails, structurals, sheared and universal plate, armor plate, wheels and axles, and heavy commercial forgings. Minor products included billets, merchant bar, bolts, and rivets. This essay primarily examines the technological aspects of the Homestead Works as seen from the industry's trade literature, with a special emphasis on forged armor plate. Secondary sources and field work are used to a lesser extent to help provide a context for these developments.

This study is a précis of a forthcoming documentation project conducted by the Historic American Engineering Record, National Park Service, in 1989-1991. Part of this project included the preparation of measured drawings of the No. 1 Press Shop. The research for the measured drawings, existing scholarly research on the topic, and the Hugh Moore Historical Park and Museum's interest in heavy forging have combined to give undue emphasis to the role of armor in this overall account of the plant. In fact, plate and structurals were the dominant product lines for most of the plant's history (see table). Difficulties in finding reliable production (as opposed to capacity), employment, and profit figures have further reinforced the misleading impression that armor was the most prominent product. The sparse references to the Carrie Furnaces are due to the fact that, while always technologically progressive, they were not the site of any major innovations or events.

The essay is divided into four sections representing the most important periods from the establishment of the plant through World War II: The Pittsburgh Bessemer Steel Company, 1879-1883; Andrew Carnegie's Homestead, 1883-1901; U.S. Steel's Homestead, 1901-1941; and the Defense Plant, 1941-1945. The postwar era is omitted primarily for reasons of space, time, and, to a lesser extent, lack of scholarly consensus on what happened.

The Pittsburgh Bessemer Steel Company, 1879-1883

> Kloman died before the mill was completed, but ultimately Homestead would provide a kind of perverted revenge upon Carnegie which even in his wildest fancies Kloman could not have imagined.
> -Joseph Frazier Wall, *Andrew Carnegie*[2]

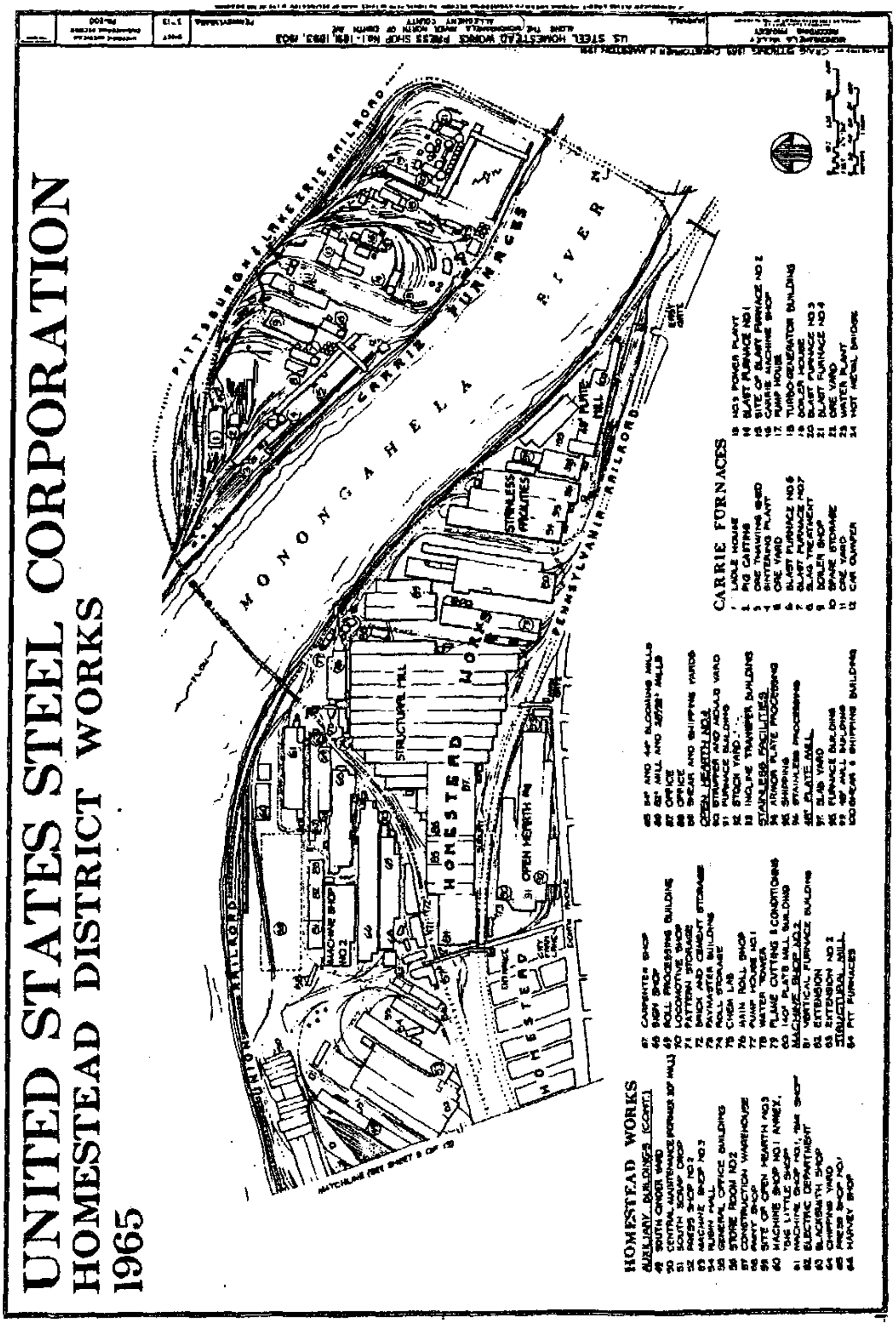
There is general consensus among historians about the events leading to the establishment of what became the Homestead Steel Works. In 1877 an imbalance between the production capacities of the converting department and the rail mill at Andrew Carnegie's Edgar Thomson Works (ET) became apparent. In order to sell its excess steel, the company created a merchant steel market. Two years later, about the same time the demand for rails recovered, ET eliminated the production bottle-

Carrie Furnaces and Homestead Steel Works
Annual Production Capacities for Selected Years: 1890 - 1960
(1,000s of tons)

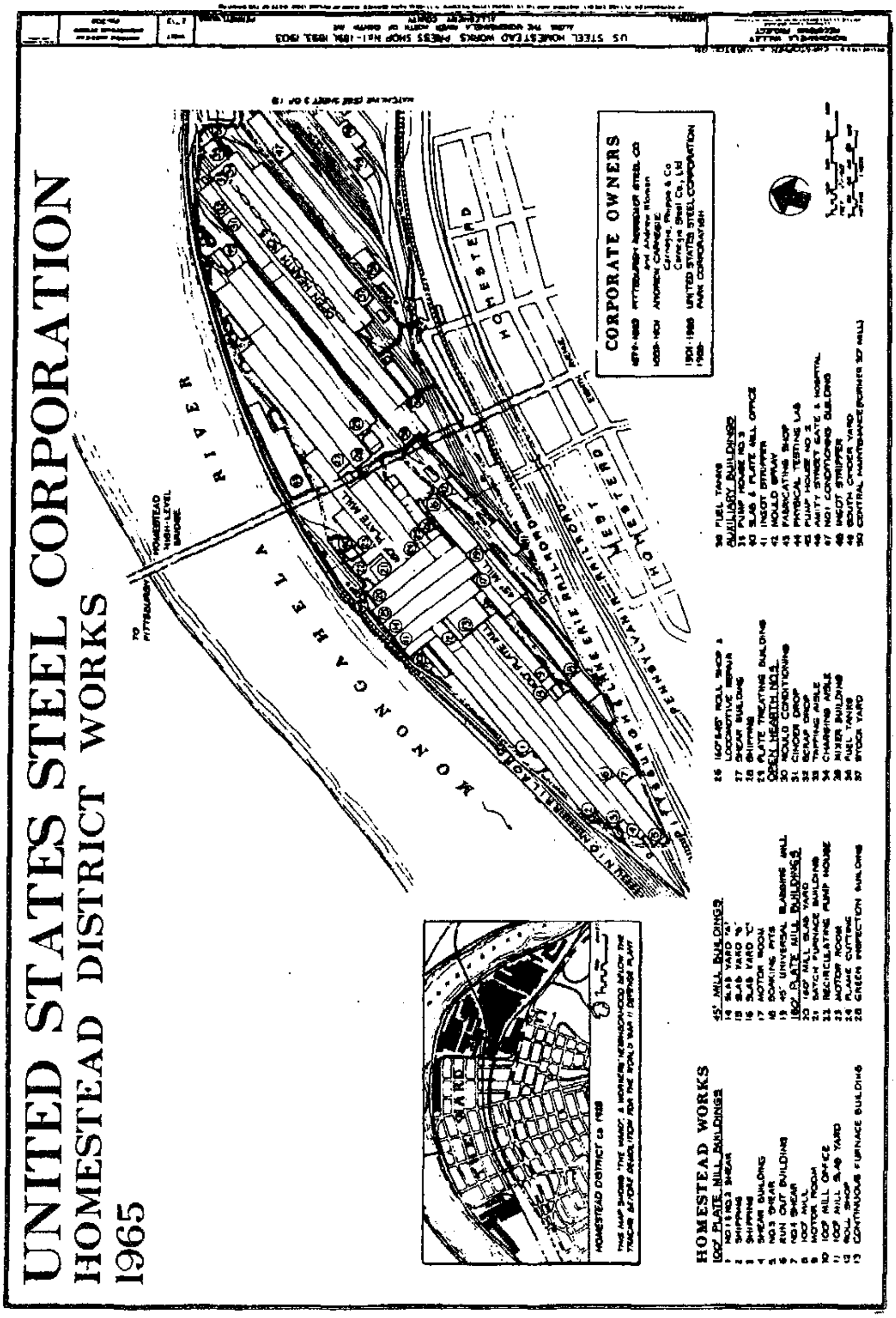
Product	1890	1901	1916	1920	1930	1938	1951	1960
Iron	150 (Lucy)	650 (Carrie)	1,101	1,152.1	1,593.9	1,586.5	2,133	2,502.8
Steel								
Bessemer[1]	180	400						
Open Hearth	n.a.	1,500	2,441	2,128	2,613.2	2,917	4,866	4,589
Plate	40	1,300[2]	901	1,229	1,335	1,711	1,888.25	2,232.7
Structural	75[3]		274.3[4]	448	764.3	864	985.9	937
Forgings (armor)	–	5	15	22.5	n.a.	6.5	n.a.	n.a.
Other			84[5]	16.8[6]				

Source: American Iron and Steel Institute, *Iron and Steel Works Directories*, for years indicated.

Table notes:
1. Bessemers dismantled 1912
2. Combined plate and structural capacity.
3. "Miscellaneous steel products."
4. Includes 6,000 tons of piling.
5. Includes 52,000 tons of steel railroad ties, 24,000 tons of rounds and squares, and 8,000 tons of "wheels, gear blanks, etc."
6. Kegs of rivets and bolts.



Site plans of the Homestead Steel Works and the Carrie Furnaces in 1965. Craig Strong and Christopher H. Marsten, delineators, HAER, 1991.



Maps showing the location of the Homestead Steel Works. Craig Strong, delineator, HAER, 1989.

THE
PITTSBURGH BESSEMER STEEL CO.,
(LIMITED).
Post Office Address, 87 Wood Street, Pittsburgh, Pa.
STEEL RAILS, BLOOMS AND BILLETS.

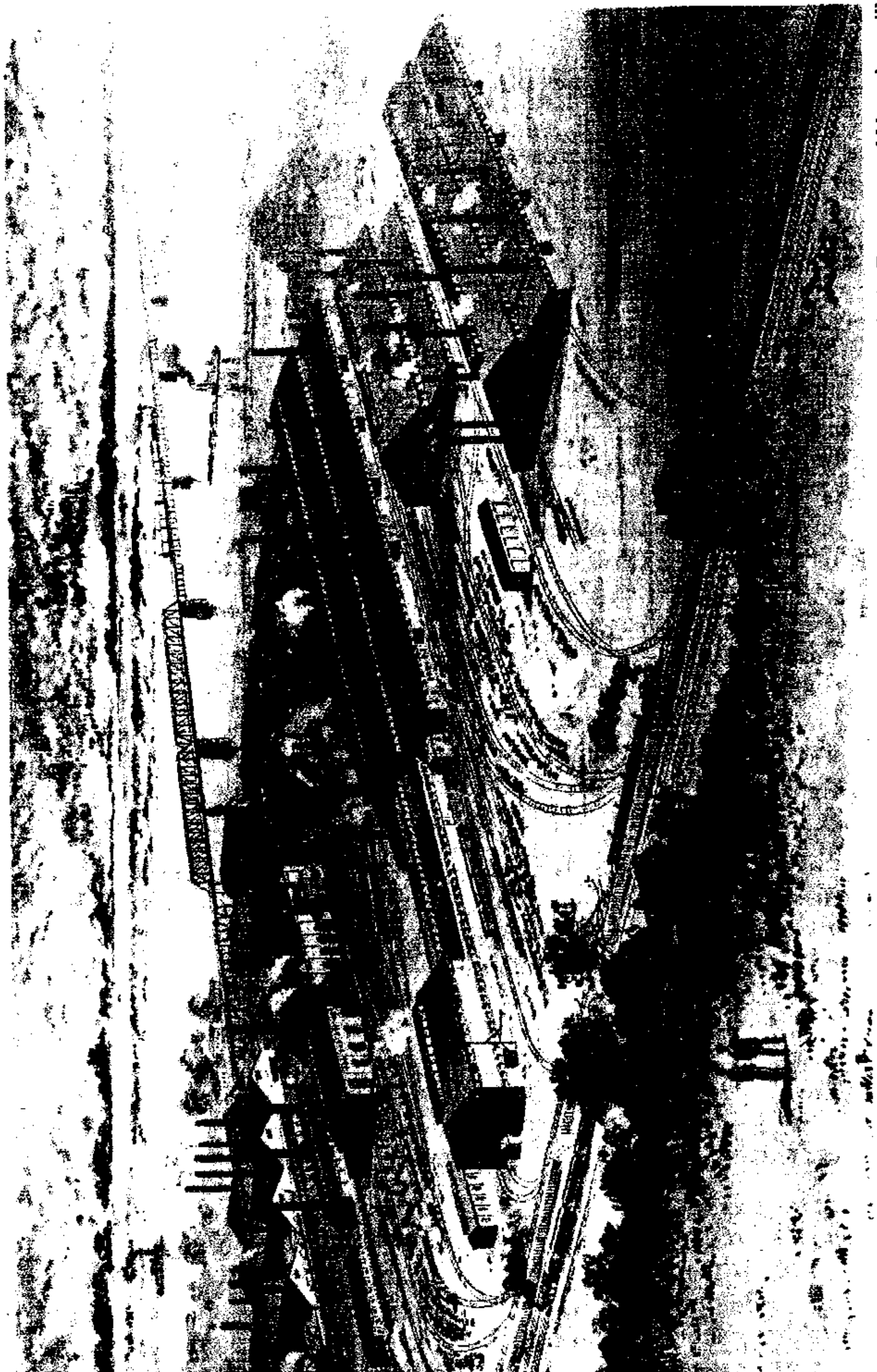
Advertisement for the Pittsburgh Bessemer Steel Company from the March 10, 1882, issue of *American Manufacturer and Iron World.* Courtesy of the Carnegie Library of Pittsburgh.

neck. The company abruptly stopped supplying merchant steel and diverted all of its Bessemer steel back to the rail mill.

To ensure a steady supply of Bessemer steel, a group of ET's customers responded by forming the Pittsburgh Bessemer Steel Company in October 1879. The partners in the new firm were William H. Singer of Singer, Nimick and Co.; Curtis G. and C. Curtis Hussey of Hussey, Howe and Co.; William G. Park of Park Brothers and Co.; William Clark of William Clark and Co., operators of the Solar Iron and Steel Works; Reuben Miller of Miller, Metcalf and Parkin, operators of the Crescent Steel Works; and Andrew Kloman, lessor of the Superior Mill. These firms were Pittsburgh's leading manufacturers and fabricators of crucible steel. The companies found that the cheaper Bessemer steel could successfully replace much of their more expensive crucible steel in some of their products. The exception to this was Kloman, an embittered former partner of Andrew Carnegie. Kloman was producing structural steel eye bars for which he held the patent, as well as light rails.[3]

In late December 1879, the Pittsburgh Bessemer Steel Company purchased land for its mill on the Monongahela River, just a short distance downstream from ET near Homestead, a subdivision named for a local country estate. A few days after the purchase, Pittsburgh Bessemer sold part of the land to Andrew Kloman. The latter constructed an independent mill that would work closely with the adjacent Pittsburgh Bessemer Steel Works. Founder of the oldest constituent of the Carnegie holdings, Kloman had been brought into Pittsburgh Bessemer because of his technical knowledge on rolling iron and steel. It was Kloman who constructed the first practical universal plate mill in the United States, thus establishing what would become a major product line at the Homestead Works during the Carnegie era.[4]

The construction of a Bessemer steel plant would have been impossible in 1880 were it not for the fact that all but one of the American patents covering Bessemer steel production had expired. The remaining patent was still held by the Bessemer Steel Company — a patent-holding company owned by the Bessemer rail companies. The patent, which had been taken out by Alexander Holley, covered the arrangement of the converting vessels and some of the auxiliaries. Holley, the nation's foremost authority on Bessemer plants, had designed every financially successful Bessemer plant in the country except the one designed by John Fritz for Bethlehem Steel. Holley's contract with the Bessemer Steel Company lapsed in 1879 and was renewed in February 1880. In his dissertation on the rise of organized labor at Homestead before 1892, Paul Krause convincingly argues that Holley,



Site plan of Pittsburgh Bessemer Steel Works of Carnegie Brothers, c. 1883-1886. The large building enclosed by the loop in the rail line is the Bessemer and blooming mill complex. The longest building is Kloman's mill. While the source is officially dated 1881, Carnegie did not acquire the works until 1883. Courtesy of Recorder of Deeds Office, County of Allegheny (Atlas of Allegheny County, 1881, plate 17.)

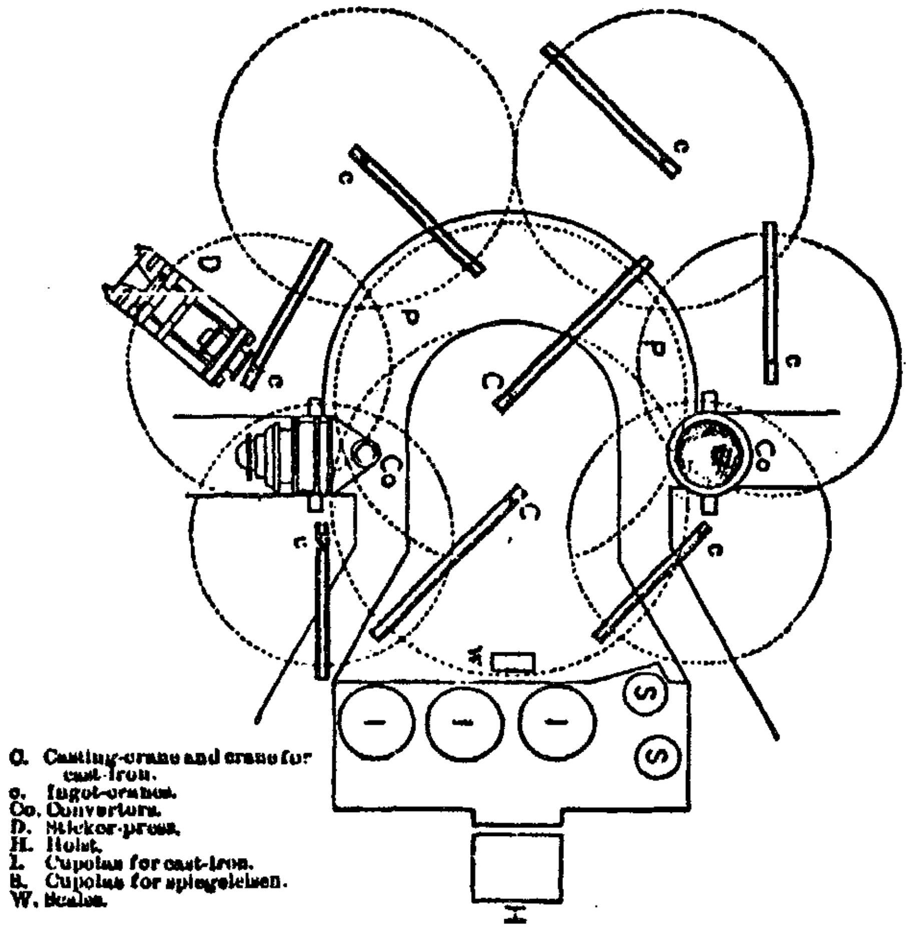
while not the official designer of the plant, gave advice on avoiding infringement of his own patent. In 1884 General Superintendent Charles L. Taylor described the converting mill:

> the two 4-ton converters are placed only a few feet above the general level (the converter trunnions being 5 feet 3 inches above the ground), at the two long sides of the building (115 feet 7 inches by 73 feet 8 inches), blowing out into the air, the cupolas being located at the one short side. There are three iron cupolas having a melting capacity of 450 tons per twenty-four hours, and two spiegel cupolas. Between the converters is the central ladle-crane commanding a casting-pit 3 feet deep and 40 feet in diameter. The iron is tapped into a ladle, which is poured with the aid of a second crane. The bottoms are put on from above by turning the converter up.[5]

Metallurgist Henry Howe published a plan of the converting mill in 1890. Pittsburgh Bessemer and Holley broke with contemporary practice by placing the converters on either side of an annular casting pit. This is in marked contrast to the usual arrangement — known as the American or Holley Plan — calling for the converters to be placed side by side in front of a circular or semicircular casting pit. Pittsburgh Bessemer avoided patent infringement because this layout was based on early British practice. While this solution could be seen as a backward step, Howe noted that it was "the amount of space available for ingot-cranes and for casting," rather than the arrangement of the vessels themselves that limited production. Indeed, he believed that Homestead held the world record for the number of heats in an eight-hour shift, though casting fewer and larger ingots. This level of efficiency was made possible by a greatly enlarged casting pit and the use of additional casting cranes.[6]

As with the converters, the designers had to work around the Bessemer Steel Company's patent covering blooming mills. In this instance, however, it was George Fritz's patent that was being sidestepped. At the Cambria Iron Works in Johnstown, Pennsylvania, George Fritz had developed a three-high (non-reversing) mill with hydraulic lifting tables that set the standard for American practice. (He was the brother of John Fritz, who developed the three-high rail mill at Cambria.) The details concerning the development of the Homestead blooming mill are even less certain than those concerning the converting mill. However, it appears that Holley, Kloman, and James Hemphill of Mackintosh, Hemphill and Co., each played a part. Krause has found evidence that Holley supplied Pittsburgh Bessemer with the blue prints that served as a model. Kloman's rolling expertise has already been mentioned. Hemphill was the official designer of record; his firm made several steam engines for Pittsburgh Bessemer and became a major supplier of heavy equipment to the industry.

The mill itself was a 28" (some sources, almost certainly incorrectly, report 30") two-high reversing mill. According to Ralph Crooker of the Engineers Society of Western Pennsylvania, the mill engine was "the first American reversing engine intended for rolling mill use . . ." Despite the uncertainty of the individual contributions, the results are clear: Crooker also reported that the blooming "mill proved itself very efficient, and during the following years many mills of similar character were built . . ."[7]



Plan of Homestead Bessemer Plant (Henry Marion Howe, *The Metallurgy of Steel* [New York and London: The Scientific Publishing Co., 1890], 331.) Canal Museum-Hugh Moore Park, Easton, Pa.

*To view restricted image of Andrew Carnegie see field notes.

Kloman died in December 1880, and even less is known about his mill than about the others. Housed in a brick building 600 feet long and 84 feet wide, with as many as five wings, the mill had an annual capacity, according to Kloman, of 50,000 tons of rails and 30,000 tons of structurals. Kloman's partners bought out his heirs and amended their charter to include James Hemphill and W.S. Mackintosh. Some of Mackintosh's shares were paid for with patents and machinery he had acquired from Kloman's estate. Thus while Pittsburgh Bessemer was the first Bessemer installation in the nation specifically constructed to manufacture steel for non-rail uses, the original concept was altered by the reorganization after Kloman's death. The steel works was merged with Kloman's rail mill and thus became tied to the vagaries of the rail market. It was soon engaged in the industry's dynamic struggle between capital and labor.[8]

The first heat of steel was blown on March 19, 1881, and the first rail was rolled on August 9, 1881 — both less than two years after the site was purchased. What was once intended to ensure a steady supply of merchant steel for its owners, very quickly became a rival to Holley's *chef d'oeuvre*, the Edgar Thomson Works: within a short time after starting operations, Homestead received rail orders for the equivalent of twenty percent of ET's market. Despite this initial promise, all but two of the partners were glad to sell out to Andrew Carnegie two and a half years later.[9]

The sale of the works to Carnegie has generally been attributed to labor strife and to a depressed rail market. At the time, the Pittsburgh Bessemer Steel Company was the only Bessemer steel plant in the nation whose skilled workers were members of the Amalgamated Association of Iron and Steel Workers. In 1882 the company's efforts to regain control from the Amalgamated were met with violence and failure. The details of the strike show a marked similarity to the better-known strikes of 1889 and 1892 and will be discussed in more detail elsewhere. A nationwide iron and steel strike by the Amalgamated followed on the heels of the strike at Homestead. This development, and the disarray it brought to the industry, greatly weakened the financial condition of the owners of Pittsburgh Bessemer.

Bridge reports that when a call for more capital went out, it was too much for some of the partners. One of the partners obtained options to sell from his colleagues and approached Carnegie. The latter offered bonds or stock worth investment cost plus land appreciation. All but two of the partners took the bonds. C.G. Hussey and W.H. Singer accepted the stock. It may be that it was the firms of these two partners that, with Carnegie, quickly settled with the Amalgamated during the nationwide strike of 1882. If so, then their better financial condition may explain why they accepted Carnegie's offer of stock. In 1901, when Carnegie sold out to U.S. Steel, Singer's $50,000 investment in Pittsburgh Bessemer had grown to about $8,000,000.[10]

Andrew Carnegie's Homestead, 1883-1901

> "Originally a rail mill, equipped with two converters, it has expanded in a few years to the largest works for the manufacture of plates and structural material in the country."[11]
> —Iron Age, November 1, 1888.

Andrew Carnegie dramatically transformed Homestead from a Bessemer rail mill to a highly mechanized, fully integrated heavy products mill. He used Homestead to reduce his dependence on the volatile rail market by diversifying into new product lines while maintaining the Edgar Thomson Work's profitable rail tonnage.[12] Carnegie and his partners installed such important new facilities as three basic open-hearth furnace buildings; three blooming mills; four structural mills; two slabbing mills; four rolled plate mills; a wheel and axle works; and an entire armor plate forge. They also acquired and expanded the Carrie Furnaces located across the Monongahela River from Homestead. This section will discuss the broad strokes of this technological change with respect to steelmaking, rolling, forging, iron making, auxiliaries, and labor.

STEEL MAKING

During the Carnegie era, Homestead became the largest open-hearth plant in the country.[13] In October 1886, the four 35-ton, round-topped, acid-lined furnaces of Open Hearth No. 1 produced their first steel.[14] Two years later, on March 30, 1888, the first heat of basic steel was cast.[15] A second open-hearth plant was constructed upstream from the 32" plate mill in 1890. A new casting pit for armor plate ingots was added by 1895.[16] The third and last open hearth at Homestead in Carnegie's time was built in 1898 just east of City Farm Lane.[17] By 1898, only 12 years after the first heat of open-hearth steel had been tapped, Homestead's open hearth capacity was 850,000 tons per year.[18]

Open-hearth steelmaking is a variation on the iron puddling process. Producer gas made from coal, and natural gas (as at Homestead) is burned in a shallow refractory-lined chamber. The heat in the combustion gases is recovered and reintroduced into the furnaces by checkerwork regenerators. In the open hearth, the carbon content of the pig iron is reduced by the addition of energy from an outside source; the Bessemer process uses the chemical energy first of the silicon and then of the carbon within the molten metal.

Open-hearth furnaces took from six to eight hours longer to produce a heat of steel than the Bessemer converters, but they produced more tons per heat. Phosphorous, which is found in most iron ores, makes steel brittle. To eliminate this effect both the Bessemer and the open-hearth processes use either low-phosphorous ores with an acid lining or higher phosphorous ores with a basic lining. While the basic lining eliminates the phosphorous, the composition of American ores meant that the basic Bessemer was rarely used. The ability of the basic open hearth to use the more plentiful higher phosphorous ores, as well as scrap metal, and suspicions about the quality of Bessemer steel are the generally accepted reasons for the eventual widespread adoption of the open-hearth process. Basic open-hearth steel overtook Bessemer production in 1908.[19] While the Homestead Works was not the first to make basic open-hearth steel, it quickly became the largest basic plant in the country.[20] Because of this, it is important to understand the reasons behind the timing of the installation of Homestead's acid and basic open hearths.

Open Hearth No. 1 and its acid furnaces were installed in 1886 as part of Carnegie's expansion into the rolled plate market.[21] Since production costs for acid open-hearth steel were higher than for Bessemer steel,[22] this decision would appear to have been prompted by the issue of quality. Indeed, Carnegie was following the precedent set by numerous companies that had substituted the cheaper acid open-hearth steel for the more expensive crucible steel in the production of boiler and firebox plate.[23] Throughout the 1880s and 1890s, the industry debated the relative merits of Bessemer and open-hearth steel. There was some claim that Bessemer steel was subject to unpredictable failure.[24] Among the reasons advanced to explain this were that the speed of the Bessemer process provided less control over the chemistry; that the acid Bessemer commonly used in this country did not eliminate phosphorus from the steel; and that the steel absorbed nitrogen from the air blown through the bath.[25] The unpredictable failures associated with Bessemer steel reduced its appeal to fabricators of tanks, pressure vessels, bridges, and steel-framed buildings.

Because the costs of the basic open-hearth process were less than those associated with the acid open-hearth process, the timing of the installation of the basic open hearths at Homestead may be tied to a patent dispute. In the United States, the Sidney Gilchrist Thomas rights conflicted with existing patents held by Jacob Reese of Pittsburgh. By 1881, the Bessemer Steel Company had acquired both the Thomas and the Reese rights to the basic process. In 1888, the Pennsylvania State Supreme Court directed Reese (who had withheld some of his patents) to surrender the patents to the Bessemer Steel Company.[26] It may be more than coincidence that Open Hearth No. 1 began the first large-scale production of basic open-hearth steel in the country the same year.[27]

In his dissertation, Thomas Misa has argued that the introduction of the open hearth was spurred by a scientific search for a structural steel. As the largest producer of structural in the nation, Homestead seems to be a major exception to his suggestion that "Americans rarely utilized Bessemer steel for structural purposes."[28] It may be that Homestead's practice was the target of those who opposed the use of Bessemer steel for structurals. With the construction of Open Hearth No. 3, Carnegie was moving toward using open-hearth steel for all structural material, and by 1908 Homestead's converters were "idle half the time."[29]

In 1898, Homestead began charging hot metal and scrap in its open hearths. Initially the hot metal was brought from the Duquesne Works in ladle cars. After the completion of the hot metal bridge between Edgar Thomson and Duquesne, hot metal was brought from ET. The success of this bridge led to the construction of the Carrie-Homestead hot metal bridge in 1900.[30] At about the same time, this experience with hot metal led to the development of the Monell process (named for Ambrose Monell). A hot pig iron and ore process, it was designed to shorten heat times. However, the Monell process seems never to have had any national importance.[31]

ROLLING: STRUCTURAL STEEL

When Carnegie's purchase of the Pittsburgh Bessemer Steel Works was announced, *Iron Age* reported that the rail mill would stop making rails and the plant would "operate the works on steel specialties."[32] *Iron Age* went on to note that Homestead's steelmaking capacity would relieve the demand for steel billets from Edgar Thomson coming from the Hartman Steel Co., Beaver Falls, Pennsylvania, and the Union Iron Mills and Keystone Bridge Works, of Pittsburgh. Despite this prediction, however, rail production continued on Kloman's finishing mill. In 1886, Homestead's capacity was estimated at 125,000 tons of rail and 50,000 tons of other steel products.[33] The following year, new rolls were cut so that smaller structural beams, angles, channels, and billets could be rolled on the rail train.[34] Once the new rolls were cut, the mill could roll either structurals or rails according to market demand.

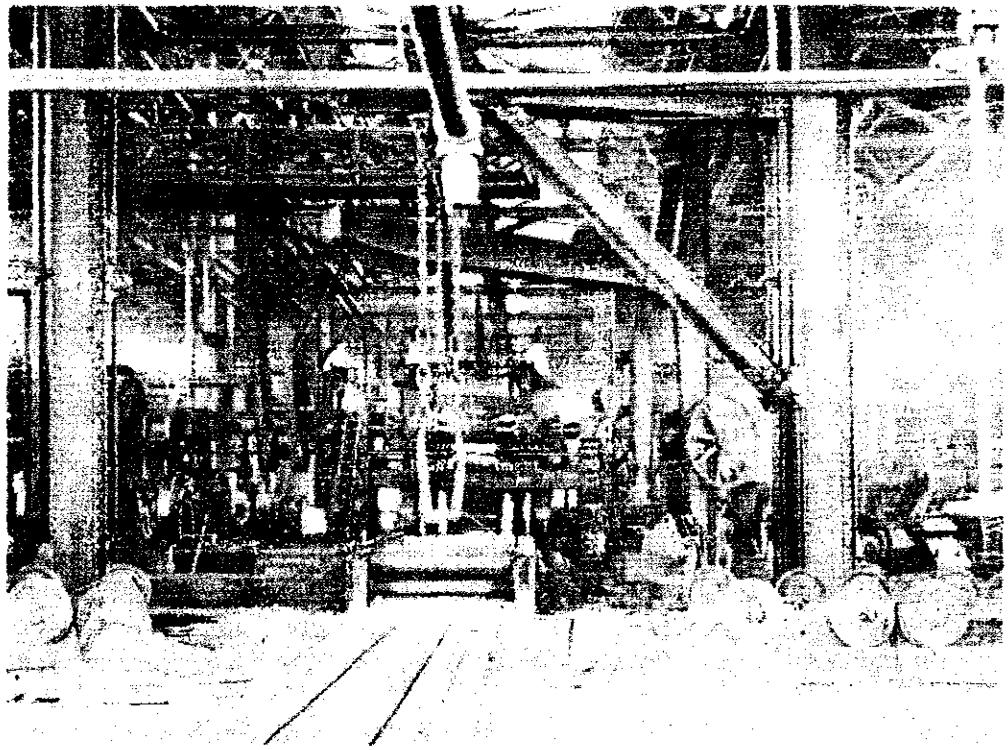
As had been the case with the rail trade, Homestead entered the structural steel trade via the acquisition of Kloman's mill. While the fate of Kloman's eye-bar mill is unknown, the company had installed a new 33" three-high structural finishing mill by 1886.[35] The following year, construction started on a new three-high 33" roughing mill to supply the 33" finishing mill. The roughing mill was placed in front of the reheating furnaces for the existing finishing stand. This arrangement was compared to the "continuous" rolling of rails adopted at Edgar Thomson shortly before.[36] The 33" structural train was located on the river side of Kloman's rail mill and rolled beams with webs up to 24". In 1890 work was begun on an even larger structural mill that produced 36" beams.[37]

Located downstream from Kloman's rail mill building on land acquired from the (Pittsburgh) City Poor Farm, the installation consisted of a 40" blooming mill and a 35" finishing stand. The two-high blooming mill rolled an average of 219,425 gross tons per year between 1911 and 1922 and had 96"-wide roll bodies. The 35" finishing mill was a three-high mill manufactured by Mackintosh-Hemphill with two engines powering two roughing and two finishing stands respectively.[38] Separate boiler buildings were constructed for each mill and group, and over the years extensive outside storage yards with overhead cranes were constructed for roll and beam storage.

Carnegie's structural mills at Homestead played a significant role in the histories of both technology and building construction. The production of structural shapes tripled in the 1880s, and steel accounted for almost all of this increased production.[39] Carnegie first rolled steel beams in 1884 at the Union Mills (which supplied structural material to Carnegie's Keystone Bridge Works) with billets from Homestead's Bessemers. The installation of the 33" mill in 1886, the conversion of the rail mill, and the construction of the 35" mill demonstrate the acceptance and increasing demand for more and larger steel beams during this period. Carnegie was the only structural producer to make the transition to steel in a major way at the time.[40] The degree of integration, the central location of the works between both the coastal and midwestern markets, the use of open-hearth steel (to be discussed elsewhere), and the owner's extensive personal connections gave Homestead a significant margin over its competitors. Even as late as 1897, when the value of steel over iron had become quite clear, Carnegie's share of the structural pool was 49.37 percent.[41] Beams rolled at Homestead were used by William LeBaron Jenney in the upper stories of the 1885 Home Insurance Building and by Adler and Sullivan in their 1890 Auditorium Building, both in Chicago.[42]

ROLLING: PLATES

At the same time that Carnegie, Phipps, and Co. announced plans to build an open-hearth plant, they also announced plans to build a wide plate mill. Attached to the south end of Open Hearth No. 1, the three-high 119" plate mill was described as the largest plate mill in the country when the British Iron and Steel Institute toured American facilities in 1890. Devised by Bernard Lauth of Pittsburgh in 1864, this type of plate mill set the standard for wide plate mills in America until supplanted by the four-high mill in the 1930s and 40s. The mill was designed to roll plate directly from the ingot, but later the plates were rolled from slabs made on the 32" universal slabbing mill. A 365-foot roller table, with an early overhead traveling crane, controlled cooling and permitted inspection of the plates. Shears and castor beads at the end of the roller table required a wider, shorter building.



The four-high 32" armor plate mill. Canal Museum-Hugh Moore Park, Easton, Pa. *Ballistic Tests of Armor Plate, as Manufactured by the Carnegie Steel Company, Ltd.*, Pittsburgh, PA: Carnegie Steel Company.

This particular layout gave the 119" building a distinctive "dumbbell" shape. The 119" mill was converted to an 84" mill by 1906. A wider 140" mill was installed in an extension of the 32" mill building about the same time as the 84".[43]

On December 27, 1886, Andrew Carnegie wrote to Secretary of the Navy William C. Whitney:

> You need not be afraid that you will have to go abroad for armour [sic] plate. I am now fully satisfied that the mill we are building will roll the heaviest sizes you require, with the greatest ease.[44]

The Navy had begun a modernization program and was seeking bidders on contracts for battleship armor and ordnance. For a period, Carnegie had declined to bid on the contracts, citing the pacifistic principles propounded in his 1886 book *Triumphant Democracy*. The construction of the 32" mill reveals that Carnegie was able to reach an accommodation between his principles and his desire for profit by insisting on only making armor because it was "defensive."[45] The mill that generated such confidence from Carnegie was the 32" universal plate mill and was constructed immediately upstream from Open Hearth No. 1. Described in 1887 as the largest rolling mill on earth,[46] it could handle 25-ton, 48" x 54" ingots and could work thick armor plates as well as slabs.[47] In 1891, both the horizontal and vertical housings were converted to four-high stands — possibly making it the first four-high mill in the world — and the horizontal rolls were widened to 110".[48] A 3,000-ton hydraulic pull-down shear cut the slabs and plates.[49] The armor for Commodore Dewey's flagship in the Battle of Manila Bay, the *U.S.S. Olympia*, was made at Homestead and could have been rolled only on the 32" mill.[50] Construction of the 32" mill marked the beginning of Homestead's long involvement with the U.S. Navy. It remained on standby as late as 1950.[51]

During the late 1890s, Homestead installed four additional plate mills made by Mackintosh-Hemphill. Three were purchased from the Bethlehem Iron Co. (predecessor of Bethlehem Steel); the fourth, the 48" mill, was built for the Homestead Works. Bethlehem seems to have sold its mills because its steel production costs were too high to make competitively priced plate.[52] A steel frame building, known as the 30" Mill Building, was constructed to house the Bethlehem Plate Mills along the river front west of City Farm Lane. The purchase included a 30" universal slabbing mill, a 42" universal plate mill, and a 128" three-high Lauth mill.[53]

About the same time as work began on the 30" mill complex, construction on the 48" universal plate mill was also started. The mill buildings were arranged in an "L"-shape to fit a triangular piece of land created by filling in a low area upstream from Open Hearth No. 2. Although it had been built by Mackintosh-Hemphill to roll plate directly from ingots, practice was later changed to roll the plate from slabs. This was done, presumably, because the two-stage reduction and the reheating it required improved the metallurgical properties of the plate. Unlike the 32" mill, the 48" mill was equipped with two sets of vertical rolls so that the edges could be worked while the plate was traveling in each direction. Described as "mammoth" by *Iron Trade Review*, the 48" mill was reportedly the largest universal plate mill in the world, and when combined with the 30", 32", and 42" universal mills gave Homestead the most extensive universal plate capacity in the world.[54] The vertical rolls produced plates of precise widths, which were preferred by fabricators of girder webbing, rail gondola cars, and overhead cranes because these plates reduced their costs of fabrication. In later years, when welding began to supplant rivetting, the rolled edges of universal plates were preferred because they were easier to weld than the sharp edges of sheared plates.

FORGING

Starting with William H. Hunt in 1881, efforts by a series of aggressive Secretaries of the Navy to replace the country's aging fleet of wooden vessels left over from the Civil War with modern steel ships led to the construction of the Armor Plate Department at the Homestead Works.[55] Inspired by theories of naval historian and strategist Alfred Thayer Mahan, this new Navy would concentrate on rendering an enemy's coastline defenseless by meeting and defeating its battleships rather than by attacking its commercial shipping.

Such a strategy depended on the availability of heavily armed and defended capital ships. Consequently, the Navy encouraged the steel industry to assemble the technical, management, and labor skills essential for the domestic production of the highest quality structural, armor plate, and ordnance steels. Described by one historian as a massive public works project to stimulate industry,[56] the all-steel Navy prompted important technological and political developments. From a technological standpoint, modernization of the Navy resulted in the production of higher quality steel through expanded use of open-hearth furnaces and the imposition of stringent standards, and the transfer of heavy forging technology from Europe, as well as advances in heat treating and production of alloy steels. In the United States the most enduring of the political changes were

> all of the circumvention of the rules and regulations, accommodated principles, and power ploys which became main threads of the later military-industrial complex.[57]

By the turn of the century, the interaction between the world powers and big business combined to produce an arms race based on the fear of technological innovations that might render a fleet, and therefore an entire nation, defenseless.[58]

Carnegie's construction of the Armor Plate Department was to deeply enmesh Homestead in the technology, politics, and profits of naval procurement.

Following the 1884 bankruptcy of John Roach, the first shipbuilder to win a Navy contract for the construction of all-steel vessels, the Navy and both houses of Congress held a series of inquiries into ordnance and armor production. Of particular interest here is that the various reports declared open-hearth steel to be much superior to Bessemer steel for ordnance and armor. The numerous board and committee reports also made it clear that Secretary of the Navy Whitney considered the armor made by Schneider of Le Creusot, France, and the gun forgings produced by Joseph Whitworth and Company, Manchester, England, the best in their classes. Whitney's 1886 call for bids for armor and gun forgings made it clear that, assuming the prices were "reasonable," the contracts would be awarded to the company that bid on both guns and plate.

Knowing what would please the Secretary, and with his full encouragement, the Bethlehem Iron Company negotiated with Schneider and Whitworth for their American patent rights as well as technical assistance. Bethlehem purchased a hydraulic forging plant from Whitworth and constructed a steam hammer along the lines of the one used by Le Creusot. Although this decision secured Bethlehem the Navy contract, it proved costly. Some of the equipment, especially the steam hammer, did not yield a satisfactory product, leading to production delays until it was replaced. While Bethlehem began shipping gun forgings ahead of schedule in 1889, armor deliveries did not begin until 1893. When Carnegie, Phipps and Company entered the armor plate business in 1890, it was able to profit from Bethlehem's experience.

When the bids were opened, several companies bid on either armor or ordnance. Only Bethlehem bid on both. Despite active courting by Whitney, and the construction of its 32" universal plate mill, Carnegie, Phipps and Company did not bid. Pacifist principles aside, Carnegie was reluctant to bid because of the rigid inspection system devised by the Navy to control quality. Carnegie believed that American steelmakers should be judged, like their European counterparts, solely on the final results, with management free to use whatever procedures it considered necessary.

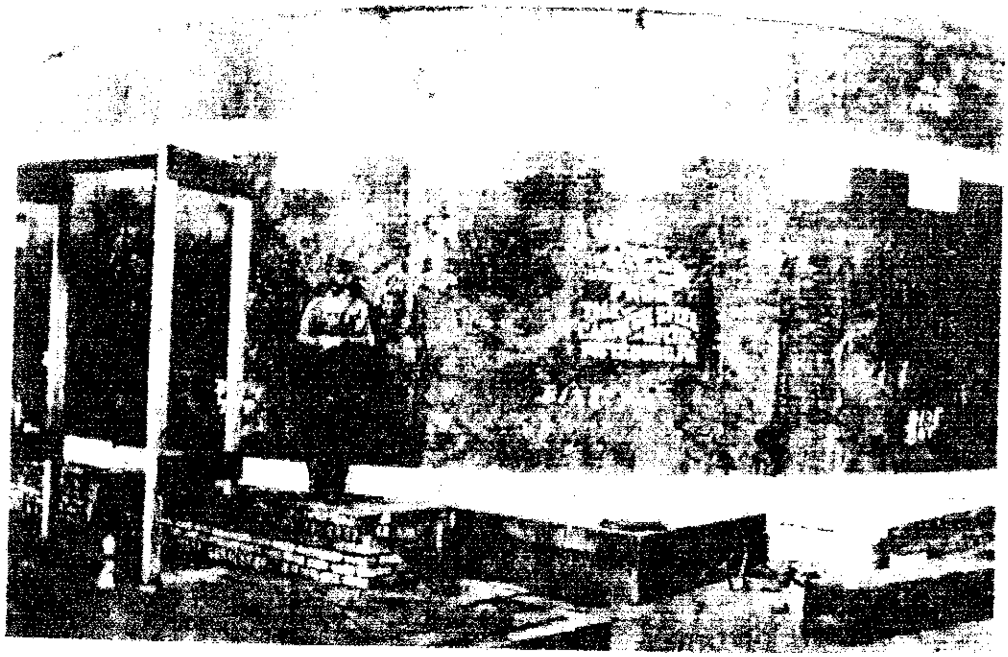
Steelmaking technology in the 1880s and 1890s lacked the capacity to produce uniform results from uniform procedures. However, the Navy's high standards, inspection procedures, and willingness to pay high prices ultimately succeeded in securing the quality it wanted. Much later, Charles Schwab admitted that these tests "were the real means of producing the quality of [structural] material now so universally used in the industry."[59] But in the meantime, conflict between the Navy's "experts" and the company's "practical steelmakers" would create trouble at Homestead. When Carnegie, in 1890, contracted for armor plate, William L. Abbott, then chairman of Carnegie, Phipps and Company, was so confident of the quality of his steel that he volunteered to submit it to an additional test, one the Navy did not require of Bethlehem.[60] Ironically, the concept of the "practical" steelmaster was a throwback to the "'practical' metallurgy" of the iron puddler[61], though one of steel's attractions for capitalists was precisely the belief that application of scientific principles to the production of steel would free them from dependence on skilled labor. Thus, Carnegie's managers resisted a tool to speed their "liberation" when the government handed it to them.

In 1890, Secretary of the Navy Benjamin F. Tracy began negotiations with Andrew Carnegie. In approaching Carnegie, Tracy sought a second source of armor plate for the ships then under construction, as well as additional production capacity for a larger fleet. Two important technological developments occurred while negotiations with Carnegie were under way. The first was the development of nickel as an alloying agent to strengthen armor steels. While its adoption by the Navy involved international maneuvering of Byzantine complexity, high nickel alloys would remain standard armor steels in the United States until the shortages of World War II required the development of alternatives. In the early 1890s, the difficulty of making and working nickel steel was so great that armor employees called for a 100 percent pay raise during the 1892 strike.

The second important technological development during this period was the face-hardening process developed by Hayward Augustus Harvey. In this updated version of a much older cementation process, the surface of an armor plate was covered with a carbon compound, such as charcoal, and heated in a furnace for as long as a month. In the furnace, the carbon combined with the iron in the steel to form a layer of iron carbide or cementite — the hardest form of iron.

The extra expense of the Harvey process did not endear it to Carnegie, who ran his works on principles of high volume and low costs. However, the process endowed armor plates with two distinctly different but important metallurgical properties: the very hard face was fused onto a very strong or tough backing. While recent research has raised doubts about the value of face-hardening armor, contemporary ballistics experts held that the hard face would shatter shells while the tough back would limit further damage to the plate.[62]

It was in the context of these technological developments and political pressures that the Navy reached an agreement with Carnegie in 1890. Carnegie, Phipps and Company agreed to produce 6,000 tons of armor (of whatever type judged to be the best), with delivery to begin in June 1891 at cost of $500 to $650 per ton. In December, 1890 the *Engineering and Mining Journal* reported that Carnegie, Phipps and Company was the first company to produce nickel-steel armor in the United States. Surprisingly, the steel was made in Homestead's Bessemers and rolled in the 119" plate mill.[63] But despite this initial success, Homestead, like Bethlehem, experienced difficulties and delays. And while Homestead was the first



Barbette for battleship *Oregon* at Homestead, from *Ballistic Tests*, Pittsburgh, PA: Carnegie Steel Company, 1898.

of the two firms to complete its contract, regular armor deliveries from both Bethlehem and Homestead did not begin for two years.

Carnegie, Phipps and Company entered the contract with the intention of rolling the armor plate on the 32" mill, and to this end converted it to one of the world's first four-high mills. The conversion added two horizontal and two vertical rolls to stiffen the rolls against breakage from the extreme pressures needed to work armor plate. At the same time the company purchased a hydraulic bending press manufactured by Davy Brothers, Sheffield, England. Able to exert approximately 2,000 to 3,000 total net tons of force, the press was used to trim and shape the armor after it was rolled.

By today's standards the press may well have been able to forge sound armor up to five inches thick from a four-foot-diameter ingot,[64] but there is as yet no evidence that it did so. The press was erected in a new building located downstream of what are now the Pittsburgh and Lake Erie Railroad tracks. Surviving engineering drawings of the press shop show that construction work continued well past the contracted armor delivery date of June 1891. In addition to the hydraulic press, Carnegie, Phipps and Company imported a 60-ton rope-driven overhead traveling crane manufactured by Craven Brothers, Ltd., Vauxhall Iron Works, Manchester, England.[65]

While some scholars have found evidence that the armor rolling process was a failure,[66] company records in the archives of the Cruiser *Olympia* Association offer evidence of at least limited success.[67] Both the four-inch armor that protected the guns and the laminated deck plates that protected the engines and boilers of the

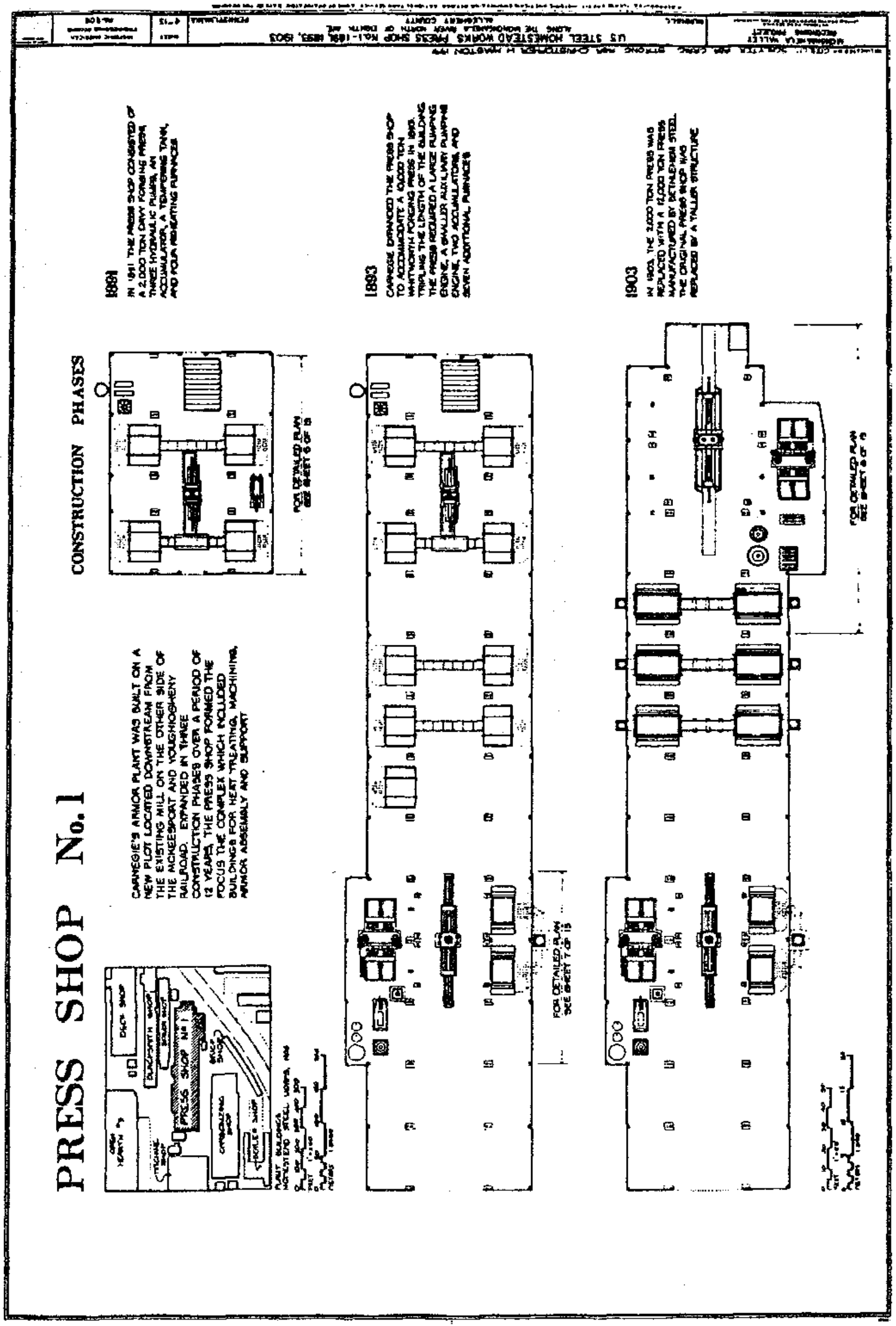
*To view restricted image of the Carrie Furnaces in 1907 please see field notes.

Olympia were rolled. In addition, the records indicate that 16-inch barbette armor manufactured in 1894 for the *U.S.S. Oregon* underwent a rolling that reduced it from 24½ inches to 17 3/16 inches after it had been forged on a press but before it was Harveyized. Indeed, the fact that Homestead's original armor-plate machine shop is labeled "armor plate deck shop" on a 1906 map clearly indicates that thin rolled armor was not a failure. Nevertheless, the rolling process was not considered adequate to meet all of the Navy's armor needs.[68]

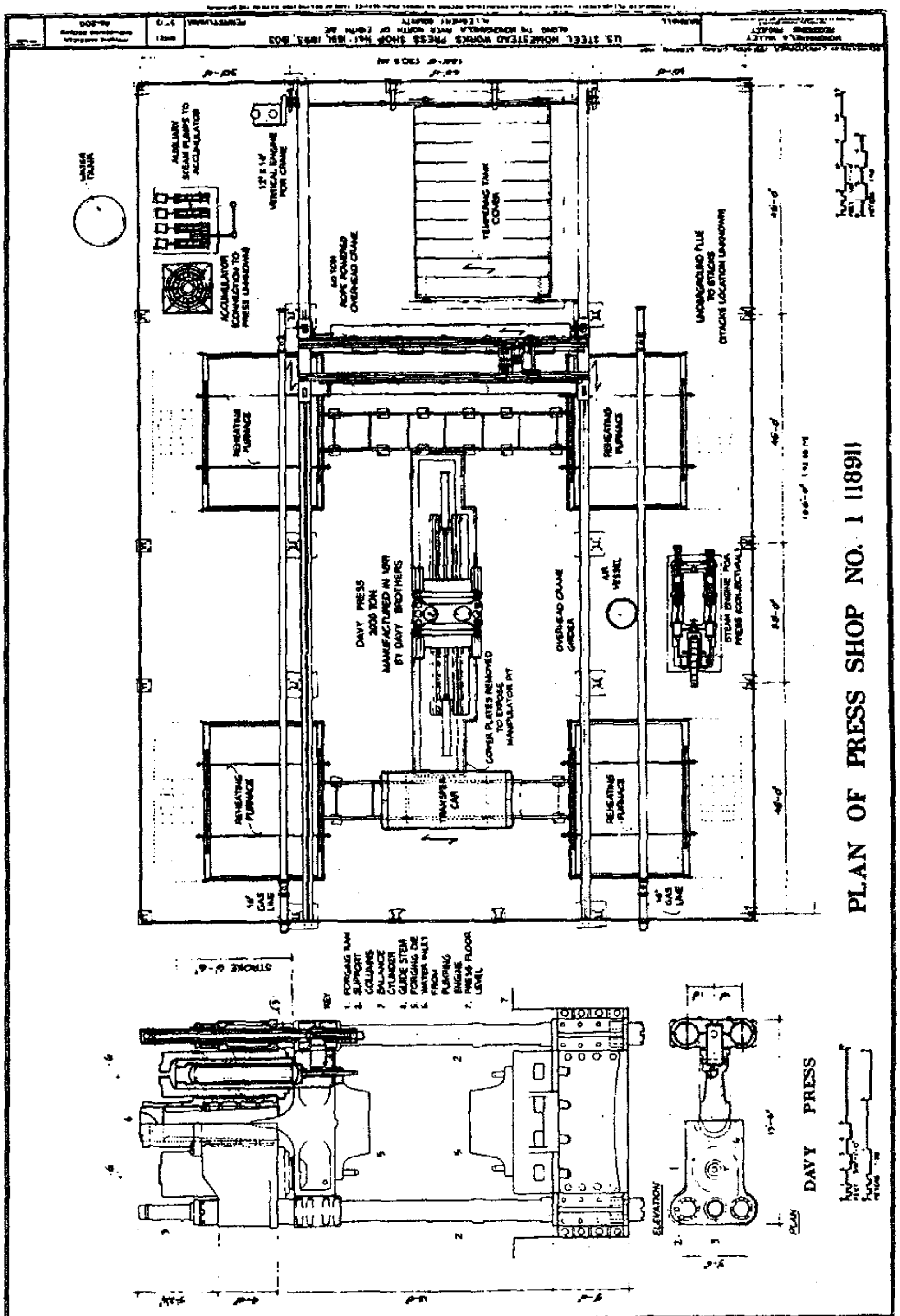
Whatever the precise reason, the company purchased an entire forging plant from Joseph Whitworth & Company. It was shipped from Manchester, England, to Homestead in late 1893. Erected in an extension of the existing press shop, it was in operation by March of the next year.[69] The press was rated to exert, depending on which source is consulted, a total force of between 10,000 and 12,500 tons. The success of the Whitworth plant that Bethlehem had imported to forge guns, and the failure of Schneider's steam hammer may have demonstrated the greater efficiency and capacity of the hydraulic press.

The purpose of forging is to break up the very coarse crystals that form when steel ingots cool. Forging, whether by hammer or press, refines the steel's crystal or grain and increases the steel's resistance to applied forces. The Navy was seeking armor plate with the highest possible resistances to deformation.

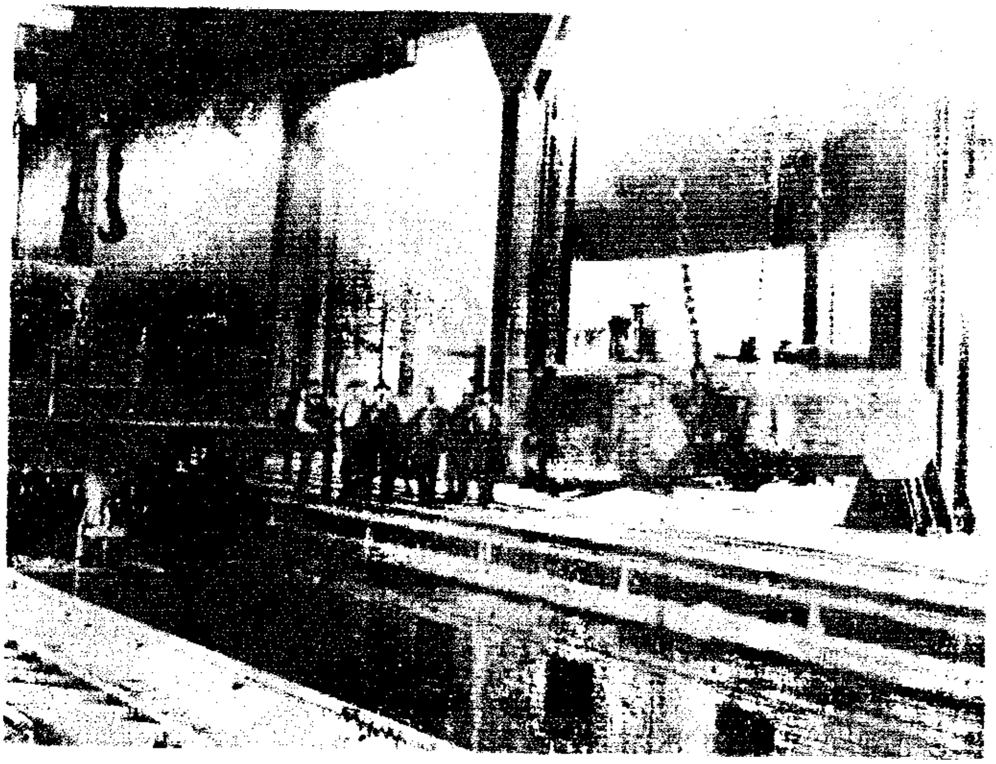
A hammer uses the sharp blows of a falling mass to work the steel. In the process, a large portion of the energy is transmitted to the foundation. The forging



Construction phases of Press Shop No. 1, Craig Strong and Christopher H. Marsten, delineators, HAER, 1991.



Plan of Press Shop No. 1 (1891), Craig Strong and Christopher Marsten, delineators, HAER, 1991.

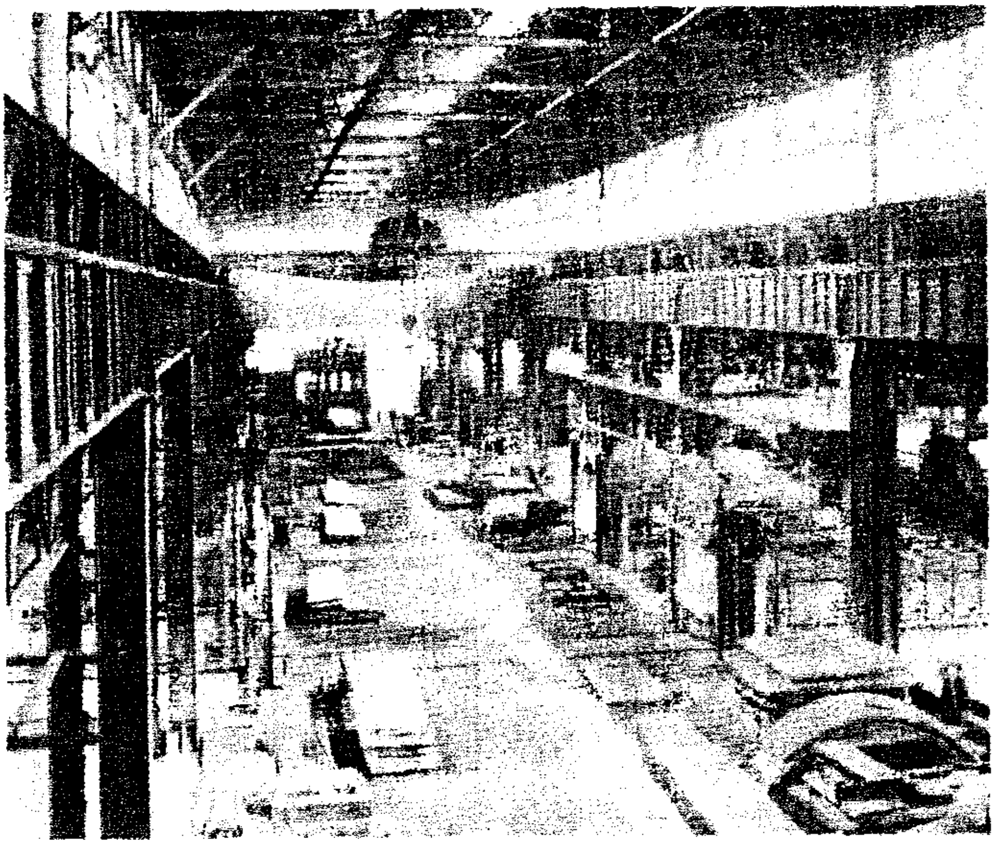


Lifting 90-ton armor plate ingot from casting pit at Homestead, from *Ballistic Tests*, Pittsburgh, PA: Carnegie Steel Company, 1898.

press works the center of an ingot more thoroughly than a hammer of the same size for two reasons. The columns act as tension members between the forging dies, thereby directing more force to the forging. Unlike a hammer, the press exerts pressure not in striking blows, but with slower, constant strokes that allow the hot metal to yield.

The Whitworth pumping engine that provided the hydraulic pressure for the Whitworth press is of special interest because it was designed according to English steam engine practice. In England the capital investment in machinery was substantially higher than the cost of labor. As a result, the engine was equipped with such features as tailstocks and joy valve gears that prolonged the life of the engine, but that also required extensive maintenance. In the United States, where contrary conditions prevailed, the maintenance costs were a liability.[70]

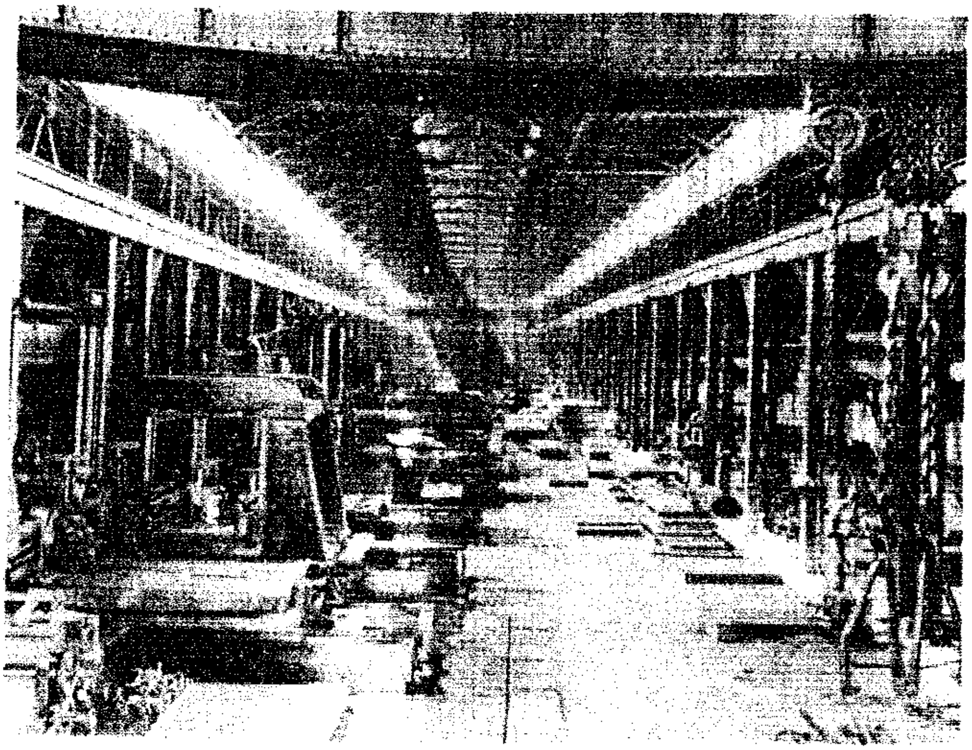
"Harveyizing" and other heat treatments for the armor plate were done in the Harvey, or Carbonizing, Shop adjacent to the Press Shop. Also built in 1893, the Harvey Shop contained regenerative furnaces for carburizing, tempering, and annealing in addition to water- and oil-quenching equipment. Quenching armor plate required vast amounts of water — as much as 200,000 gallons per plate in 1895 — so a new steel plate water tower was built to replace the wooden tanks that witnessed the momentous events of July 1892. When more open-hearth furnaces were added to Open Hearth No. 2 around 1895, a deep casting pit was constructed to facilitate the pouring of large armor-plate ingots.



Armor Plate Bending Shop at Homestead, from *Ballistic Tests*, Pittsburgh, PA: Carnegie Steel Company, 1898.

It is important to note two other technological innovations of the 1890s. The first — a process named for W.E. Corey, superintendent of the Armor Plate Department (and general superintendent 1897-1901) — strengthened a plate by subjecting it to a second forging after it had been face-hardened by the Harvey process. Although frequently referred to as the Corey process, reforging was probably developed simultaneously at Bethlehem. Indeed, given the pattern of cooperation and collusion that later emerged, reforging may well have been a joint project. The cementite formed during the Harvey process is not only hard, but also brittle. This brittleness actually weakens the armor plate's ballistic resistance. The Corey process uses the forging press to break up the cementite crystals into smaller grains with a more uniform distribution. When combined with additional heat treatments such as tempering, reforging yielded a substantially stronger and less brittle face composed of tempered martensite.[71]

The technical accomplishments of the Armor Plate Department at Homestead were recognized internationally when Carnegie's forged, face-hardened, reforged nickel-steel armor won a Russian naval contract in 1894. It was with no little national pride that the ballistic tests for the contract were held at the U.S. Navy testing grounds. That year, profit margins on armor helped Carnegie Steel earn $4 million despite a severe nationwide depression.



Armor Plate Machine Shop at Homestead, from *Ballistic Tests*, Pittsburgh, PA: Carnegie Steel Company, 1898.

In 1895, the Krupp Works of Essen, Germany, developed an improvement on face-hardened nickel steel armor. Known as Krupp Cemented armor, it used a nickel-chromium alloy, a gaseous carburisor instead of charcoal, and decremental hardening. Chromium allowed the hardening of thicker plates but at the same time made the steel more difficult to work. Special modifications had to be made to the cementing furnaces to prevent the natural gas or paraffin carburisor from burning. Decremental hardening produced a thin layer of cementite in front of a moderately hard layer. The back of a Krupp Cemented plate was a very thick soft steel layer. These extra production steps made Krupp armor more expensive than Harveyized nickel steel; Krupp's high licence fee and $45 a ton royalty added to the costs. Nevertheless, naval architects felt they could save money because the Krupp Cemented process allowed them to reduce the thickness of the armor without sacrificing its protective features.

Internal records of the Bethlehem Iron Company suggest that Krupp's patents covered only the superficial aspects of production and that the firm was not fully forthcoming about the finer details of the process. Consequently both Homestead and Bethlehem developed their own solutions to handling the difficult alloy. The result of these efforts, according to one historian, was that "by the end of World War I, most foreign [i.e., non-German-made Krupp Cemented] armor was actually superior to that produced by Krupp itself."[72]

In late 1893 a lawyer representing four former employees of the Armor Plate Department approached Navy Secretary Hilary Herbert, claiming to have evidence of fraud at Homestead. Herbert reluctantly agreed to pay the employees 25 percent of any fines imposed on the company. The Navy investigation found that the company had concealed it retreatment of a batch of armor plates selected for ballistic testing; had filled in surfacc defects in the plates; and had produced plates that were unevenly tempered. The Secretary imposed a fine equal to 15 percent of the value of the armor produced between November 1892 and September 1893.

When informed of the charges, Camegie objected that the investigation was conducted without the company having an opportunity to defend itself. Claiming that the Secretary of the Navy was overzealous, Camegie made a personal appeal to President Cleveland asking for a new investigation. Caught between the need to show his confidence in his Secretary and the need to resolve the issue — which might not happen if the second investigation reached the same conclusion — Cleveland reduced the fine to 10 percent, or $140,489. Congressional hearings came to the same general conclusions as the Navy investigations.

The problems seem to have arisen out of the aftermath of the 1892 strike, the difficulty of armor plate manufacture, and a clash with the Navy over manufacturing styles. At that time, Charles Schwab had left the Edgar Thomson Works at Braddock to return to Homestead. In making Schwab the new general superintendent of the Homestead Works, Camegie wanted the benefit of Schwab's charismatic style to bring the plant into normal operation. But the vast size and diversity of Homestead made it impossible for Schwab to closely monitor all of the divisions; especially in light of the pressing need to restore calm. As his biographer notes, Schwab did not instigate the fraud but neither did he stop it when he became aware of it. Schwab's attitude toward the Navy inspectors and his desire to get the results his own way were certainly consistent with the industry's tradition of rugged self-reliance. The company's handling of the recent strike had only reinforced this tradition. That the company actcd out of confidence and pride without consulting the Navy is a reflection of the newness of the growing relationship between the military and industry.

About 1895, this lack of precedents to guide the relations between the government and the steelmakers led to a public debate over armor prices that would continue for years.[73] As Bethlehem Iron and Carnegie Steel completed their initial contracts and recouped their initial investment, the Navy Secretary believed that the premium prices paid to subsidize development of an armor-plate industry were no longer needed. At Homestead, of the estimated $3 million cost of the Armor Plate Department, only $500,000 represented the company's own money. The remaining cost was financed by the Navy in the form of inflated prices as high as $625 a ton. A severe economic depression and greed led the companies to resist the Secretary's effort to cut off the subsidy.

The Navy's efforts to reduce the price were hampered by its dependence on the steel companies to supply its steel ships, and by collusion between the two companies. The price of armor was not, as one historian has noted, a function of market forces, but of political negotiation.[74] Members of Congress became outraged upon learning that Bethlehem had contracted to supply armor to the Russian Navy at $250 per ton (later raised to $524). Once again the Navy and Congress conducted investigations. The Secretary concluded that $400 per ton was a fair price based on a roughly 50 percent profit on an estimated $270 per ton manufacturing and overhead costs. In addition to suggesting a price of $300 to $400 per ton, a Senate committee also recommended the construction of a government armor factory.

In his biography of Andrew Carnegie, Joseph Wall cites an 1897 letter from Schwab to Carnegie reporting on a difficult armor order that would cost $175 a ton to make.[75] The steelmen glossed over the amount of subsidy built into the old prices and pointed to the size of their investment and overhead costs as justifications for the prices. The low export prices, they argued, were necessary in order to keep the armor plants open in depressed times and in lieu of a guaranteed level of Congressional expenditure.

When investigators asked to see their books, the companies refused on the grounds that they did not want to reveal their secrets to their competitors. This was an outright misrepresentation as Bethlehem and Carnegie had, and would continue to exchange technical and political information. While Secretary Herbert had indications of an international armor cartel as early as 1894, a complicated network of holding companies and licenses surrounding the Harvey patents tended to bind all armor makers into making common cause. This became clear when in 1897 both Bethlehem and Carnegie refused to bid on a contract to supply armor at $300 per ton. As a further gambit in the negotiations over price, both companies offered to sell their armor plants to the government. Carnegie was willing to sell the Armor Plate Division for $2 million — $1 million less than "cost" — claiming that the capital could be better used in other product lines.

The impasse was quickly, but temporarily, resolved in the spring of 1898 with the naval buildup for the Spanish-American War. Carnegie and Bethlehem split the orders at an average of $400 per ton. After the war, the debate resumed until Congress authorized the construction of an armor plate plant in South Charleston, West Virginia, during World War I.

IRON MAKING

In the spring 1898, Carnegie purchased the Carrie Furnaces to supply pig iron for the Homestead Works. The Carrie Furnaces, one of only three independent iron companies then remaining in the Pittsburgh district, were located across the river from the Homestead Works at Rankin. Carnegie already owned 15 of the 30 blast furnaces in Allegheny County, but such was the hunger of his Bessemers and open hearths that even with the acquisition of the Carrie Furnaces' 18,000 tons of pig iron per month, the company still had to buy 2,000 tons from the merchant iron market.[76] The celebrated Lucy Furnaces were included with the Homestead works when the Pittsburgh Bessemer Steel Company was reorganized in 1886 as Carnegie, Phipps and Co. From this it seems reasonable to assume that Homestead got much, if not most, of its pig iron from Lucy prior to the acquisition of the Carrie Furnaces. Additional motivations for the purchase was the need to supply Open Hearth No. 3, which was under construction at the same time. Furthermore, 1898 saw the explosion of the *U.S.S Maine* in Havana Harbor in February, and the outbreak of the Spanish-American War.

Homestead's heavy product mix has meant that throughout its history, war has brought prosperity and increased production to the works. In addition to the two stacks, the facilities at Carrie included coke ovens and a Uehling pig casting machine.[77] The opening of the Hot Metal Bridge in late 1900 completed the integration of the Homestead Works.[78]

AXLES

After the profitable armor plate venture, Carnegie sought to manufacture more finished products. In addition to further profits, Carnegie saw this forward integration as a means to insure corporate survival and dominance. One of the product lines that interested him was steel railroad cars. The issue as to whether Carnegie Steel should continue selling steel to all car fabricators, enter an agreement with Charles Schoen of the Schoen Pressed Car Company, or build its own car plant became the subject of an extended internal debate among the partners. After agreeing with Carnegie that the company should build its own works, the partners reconsidered: Carnegie Steel could sell more steel through Schoen than by competing with it and all the other companies.

In February 1899, Schoen agreed to buy all its plate, structurals, and axles from Carnegie at a fixed rate for ten years. Carnegie agreed not to build a car works, but retained the right to terminate the contract with one year's notice.[79] Construction on the Howard Axle Works to supply the axles for Schoen was underway by April 1899. Located in West Homestead and connected to the Homestead Works by the Union Railroad, Howard Axle Works was built on the future site of the defense plant's slab yards for the 45", 100", and 160" mills. The first axle was forged in April 1900.[80]

AUXILIARIES

In addition to a tremendous expansion of the physical plant, the Carnegie era brought significant changes to the work place at Homestead. The growing use of mechanization to increase speed and productivity reduced the number of skilled employees.

The Bessemer process reduced management's dependence on the judgement and experience of the skilled iron worker. Mechanization of steel production transferred production knowledge from the skilled workers to management. Management was now able to train anyone it chose and still produce an acceptable product. Because machines could do more and heavier work faster, management needed fewer and less-skilled employees to produce a ton of steel. Management's move to gain control of the work place was stimulated by the industry's search for profits and survival through reduced costs and greater production.[81]

At the Homestead Works, Carnegie and his partners installed numerous labor-saving auxiliaries. Two of the more important examples were cranes and chargers for material handling. Many of the machines installed in the 1880s were developed and patented by Julian Kennedy and Henry Aiken.[82] Examples of their innovations include the hydraulic pivot cranes serving the 32" slabbing-mill soaking pits, the 119" plate-mill slab-heating furnaces, and the tapping side of Open Hearth No. 1. These pivot cranes were superseded by the introduction of the overhead traveling crane. Also developed during the 1880s, a traveling crane serviced the cooling bed of the 119" plate mill, and a steam-engine-powered, cable-driven overhead crane was installed in the original 1891 forge shop.

A president and general manager of the Alliance Machine Company, still one of the leading mill crane manufactures, reported in 1926 that Homestead "was the first big steel plant that went definitely to the use of electric cranes."[83] Electric cranes installed in the structural mill beam yards by early 1894 displaced many laborers.[84] These cranes are featured in a 1895 photo essay on the plant.[85]

The open-hearth-furnace charging machine was another auxiliary introduced during this period. The higher heat of the open-hearth furnace eliminated the need for the puddler's skill.[86] Open hearths required a great amount of labor to charge them with pig and scrap under adverse conditions. Samuel Wellman, who played the same role in relation to the open hearth that Holley had for the Bessemer, automated the charging process. Several Wellman charging machines were installed at Homestead in 1896[87] and soon became standard equipment. In addition to saving on labor costs, the charging machines increased the number of heats per day by reducing the charging time.

LABOR

Carnegie's Homestead — the Homestead of the 1880s and 1890s — was the era of the tumultuous transition from iron to steel.[88] In his dissertation *The Road to Homestead*, Paul Krause argues that the transition from iron to steel brought with it values that clashed with those developed and nurtured by the working classes.[89] Implicit in this argument is the concept that the proper production of iron and the proper production of steel required mutually exclusive cultures. That transition, like the transition the industry is currently experiencing, exacted a human price. Despite the fact that it never produced wrought iron, Homestead nevertheless played an extremely visible role in the realignment of the production culture.

When Carnegie acquired the Pittsburgh Bessemer Steel Works in 1883, he also acquired a contract with the Amalgamated Association of Iron and Steel Workers. A craft union deriving its strength on the exclusive production knowledge of its members, the Amalgamated was at the peak of its strength in the 1880s. The strikes of 1882 and 1889 at Homestead revealed that Homestead's lodges were "the keystone in the structure of ninety-four lodges in the district, which constituted one-third of all the lodges in the union."[90]

In January of 1882, employees of the Pittsburgh Bessemer Works refused to sign a contract that both prohibited membership in the Amalgamated Association of Iron and Steel Workers and prohibited three or more employees leaving without advance notice.[91] Violence broke out when the company hired nonunion workers. It also hired armed guards backed up by the county sheriff, and evicted strikers from company housing. The burgess of Homestead deputized strikers and the workers formed an advisory committee to coordinate activities and maintain order. After defaulting on several contracts, the company reopened the works with both union and nonunion shifts. Superior production by the union workers quickly displaced the nonunion workers.

The victory at Homestead, however, proved an exception to the union's attempt to organize the steel industry; by 1889 Homestead was still the region's only unionized steel mill. Following a defeat of the Amalgamated at Edgar Thomson, Carnegie's new contract for Homestead called for a sliding scale based on the price of steel that would cut wages 25 percent overall, enforce a 12-hour day, a nonunion shop, and a January expiration date. (This latter issue was important because striking workers could not hold out as long during winter.) Both the Amalgamated Association and the Knights of Labor, who contrary to union policy cooperated with each other in Homestead, strengthened their organizations through membership drives.

Once again the Amalgamated formed a joint advisory committee, and sealed off all approaches to Homestead with armed steelworkers. Ten days after locking out the employees, the company sent in thirty-one nonunion employees, accompanied by the county sheriff, by train. A very large crowd met the train. Yielding passage into the mill for the sheriff, the crowd blocked the nonunion workers. The crowd then assaulted the workers who did not flee. When the sheriff returned two days later with 125 armed deputies, the group was met by an even larger crowd that succeeded in intimidating the deputies. When one deputy decided to leave, his fellows followed suit. (On this occasion the company hired, but appears not to have used, 100 Pinkertons.)

These strikes reveal conditions unique to Homestead in the 1880s. The strength of the Homestead lodges lay in the superior production of its members, their ability to enlist the support of unskilled workers, and, most importantly, the almost monolithic support of the community. Unlike the situation in most communities in the region, the workers in Homestead were active in the political life of the community, and prominent labor leaders dominated the town's elected offices during the last years of the decade.

The economic climate also played an important role in the workers' struggles. In 1882 Pittsburgh Bessemer had been unable or unwilling to sustain losses during a depression. In 1889 Carnegie, Phipps and Company was reluctant to close the works and miss out on the profits of a seller's market. In 1892, the profits of the previous three years, the recapitalization of the Carnegie interests, and an economic downturn put the company in a much stronger position to withstand the losses of a long strike.[92]

Henry Clay Frick, then chairman of Carnegie Brothers, considered the 1889 settlement a disaster because, in the words of Carnegie's biographer, it gave "the union full authority to hire and fire as well as determine the working conditions within the plant."[93] Capital had looked to science and cheap steel to free itself from its dependence on the workers' proprietary knowledge. In 1892, Homestead was a modern, highly mechanized steel plant run under a labor system developed for an iron works. Unlike the other plants in the district, it had facilities that were new and had been installed without eliminating jobs. That is to say, most of the "labor-saving" devices at Homestead did not replace existing equipment and therefore did not displace existing workers. Admittedly, fewer workers were employed than at older, roughly equivalent installations elsewhere, but net employment at Homestead should have increased dramatically.

The introduction of electric appliances, such as overhead cranes, did begin to displace unskilled workers around 1890. According to labor historian David Montgomery, machinery displaced an estimated 500 workers by 1900.[94] In the absence of reliable employment figures it is difficult to be sure, but it seems reasonable to assume that the construction of two open-hearth buildings, the 35" structural mill, and the Armor Plate Department during the 1890s required many more skilled and semiskilled workers than were displaced in existing facilities by machinery.[95] This seems to be confirmed by census figures for Homestead. Between 1890 and 1900 the population in Homestead Borough increased from 8,045 to 13,205. The majority of the new residents were Eastern Europeans and Blacks from the upper South who were brought in as strike breakers and semiskilled labor.[96]

As talks commenced in January 1892 on a new three-year contract between the Homestead lodges of the Amalgamated and Carnegie, Phipps & Company, the union did not anticipate any difficulty in concluding a contract with the company.[97] However a new player, Henry Clay Frick, greatly affected negotiations.

Frick became chairman of the new Carnegie Steel Co. on July 1, 1892. His ruthless treatment of strikers at his coke works had already made him notorious among workers. The contract proposed by the company was very similar to the one it had put forward in 1889: a January expiration date, a minimum tonnage rate reduced from $25 to $22, and a wage scale for unskilled workers pegged to the tonnage rate. Frick also insisted that the Amalgamated accept these terms by June 24, or forfeit company recognition of the union. The company defended its proposed reduction in the minimum tonnage rate on the grounds that it could not afford the higher rates, especially after spending millions to modernize the Homestead Works. The Amalgamated claimed that the company had deliberately depressed steel prices by cornering the market. This situation had been further aggravated by the importation of cheap steel from abroad.

For the most part, Frick and Carnegie found unacceptable the union's wage demands (which would cost the company too much money), as well as its workplace practices (which interfered too heavily in the management of the plant). Both men and their top management felt that the sliding scale unfairly favored the Amalgamated. They reasoned that the workers profited when the tonnage rate increased, but that the company had to absorb a loss when the rate fell below the minimum. However, the company never really accepted the sliding-scale concept and sought to take advantage of the depressed market to break the union.

The Carnegie Steel Company aimed to eliminate the Amalgamated from Homestead much as it had done with the union at Edgar Thomson in 1888. Indeed, it planned to eliminate all of its unionized workers. Contrary to Carnegie's public pronouncements in defense of organized labor, the company simply refused to co-exist with the Amalgamated. Carnegie's obsession to reduce operating costs in order to undercut his competition and to dominate the steel market doomed the Amalgamated.

In anticipation of the inevitable conflict, Frick constructed a high wooden fence around the perimeter of the mill and locked out the workers before the contract expired. The workers organized themselves by forming an advisory committee from the officers of the various lodges and sealed off the town and the mill.

The committee refused to let the sheriff's deputies guard the mill and the sheriff declined the committee's offer to provide bonded guards from its own membership. On the evening of July 5 two barges headed upstream for Homestead carrying some 300 Pinkerton guards. On the morning of July 6, the advisory committee received word that the barges were on their way. A crowd assembled and followed the barges to the fence surrounding the mill. Realizing that the choice was between letting the Pinkertons and any nonunion workers who might be on board restart the mill, and knocking down the fence and being accused of destroying private property, the crowd chose the latter course and rushed to the landing.

Shots rang out, leaving several wounded on both sides. Despite several efforts by the Pinkertons to surrender, the workers persisted in efforts to destroy the barges until late afternoon. About 4 p.m. Hugh O'Donnell, chair of the advisory committee, appealed to the workers to let the sheriff take the Pinkertons away. At this time, or shortly thereafter, the Pinkertons raised a white flag[98] and were disarmed. The crowd became an ugly mob and as the Pinkertons disembarked they were forced to run a brutal gauntlet through the mill and into the town.

Acting on a report from one of his agents, Governor Pattison ordered the Pennsylvania National Guard to Homestead on July 10. The full complement of 8,000 guards arrived the next day. The company restarted the mill with nonunion labor under the protection of the militia. On July 23, anarchist Alexander Berkman attempted to assassinate Frick. While the attempt was not tied to the union, it helped turn public support away from the strikers. Discussions of a boycott of Carnegie products by the American Federation of Labor came to naught. Conditions for the strikers and their families became increasingly hard. On November 21 a vote to end the strike won by a narrow margin.

The Homestead strike was a symbolic turning point in the history of the American steel industry. Eminent labor historian Philip S. Foner summarizes it thus:

> The Amalgamated Association continued to exist for years after the Homestead Strike, but as an effective organization it was shattered. The Carnegie Steel Company dominated the industry, and set the pattern for other mills. The defeat at Homestead not only meant the end of unionism at the Carnegie plants, but lead to the downfall of unionism in the entire industry.[99]

It was not until the late 1930s that steelworkers were organized into a national union under the auspices of the United Steel Workers of America.

Conversely, the Homestead strike was a victory for the steelmakers and the corporate capitalists who would follow. According to noted labor historian David Brody:

> Unencumbered, the steelmaster could base his labor decisions on the objective criteria of what minimized his cost and maximized his profit. He could with impunity manipulate the wage rate, step up the work, and extend the twelve-hour day and the seven-day week. The antiunion triumph completed economical steel manufacture.[100]

Furthermore, Professor Charles McCollester has noted that a further consequence was

> the long-term rigorous suppression of worker involvement and participation in decision-making within the production process.[101]

In fact, as Fitch has observed, the suppression extended beyond the workplace and into the community. While many other steel towns experienced the nonunion era with Homestead, the fact that the community had experienced a decade of civic life dominated by labor made the situation more painful. For Homestead, the transition to a new civic life dominated by capital was sudden and demoralizing.[102]

United States Steel's Homestead: 1901-1941

In spring 1901, Andrew Carnegie sold the Carnegie Company to the United States Steel Corporation for around $400,000,000. The story of the sale has been retold many times and need not be repeated here.[103] Suffice it to say that it was the result of numerous converging forces. These included, but were not limited to, the desire of Carnegie's major customers to reduce costs by producing their own steel; J.P. Morgan's attempt to prevent Carnegie from entering the finished steel market; the desire of Carnegie's partners to realize their profits; a national trend towards industrial consolidation; and Louise Carnegie's desire that Carnegie begin his often-promised but long-delayed philanthropic career. Obstacles to the sale included Carnegie's dislike for Morgan and his philosophy, a reluctance to abandon the field while on the brink of total victory, and the pleasure he derived from the process of building mills and railroads.

The formation of U.S. Steel had numerous long-term impacts on the Homestead Works and its surrounding communities. The most important was the replacement of Carnegie's business philosophy with that of Morgan and Elbert H. Gary, chairman of the board of U.S. Steel. Instead of Carnegie's maximization of profits through cost-cutting and technological efficiency, U.S. Steel sought industry-wide stability through predictable high prices.[104] In addition, U.S. Steel's need to pay out dividends to public stockholders — a marked contrast to Carnegie's large-scale reinvestment of dividends — led to a slowing down in the modernization of equipment. Gary's "cooperative competition," which allowed other firms to remain profitable, meant that Homestead did not actively challenge Bethlehem Steel's introduction of the wide-flange beam for more than fifteen years. Moreover, the widely located subsidiaries of the new corporation diluted U.S. Steel's interests in western Pennsylvania. Instead of trying to serve all markets efficiently from the Monongahela plants, U.S. Steel moved to a regional market system. Thus, in addition to closing numerous poorly located or inefficient plants, U.S. Steel began construction of the Gary Works to serve midwestern markets.

During Gary's tenure, the industry developed a basing point pricing system for delivered steel that further weakened western Pennsylvania's position *vis à vis* Chicago. Regardless of how freight rates were charged, lower costs of material, more modern facilities, and shorter transportation distances to midwestern customers favored Chicago's mills over Pittsburgh's. Because the midwestern mills enjoyed higher profits, they were given priority over Pittsburgh whenever U.S. Steel moved to modernize or expand production.[105]

The acquisition of Tennessee Coal and Iron offered a serendipitous opportunity to move into the South. These decisions to expand into other regions meant a gradual waning of the Monongahela Valley's importance to U.S. Steel as a site for

*To view restricted image of 12,000-ton forging press manufactured by Joseph Whitworth & Co., Manchester, England, see field notes.

modernization. The general maturation of Pittsburgh's industry and the increasingly scarce bottom land for plant expansion also limited growth at Homestead.[106]

Nevertheless, Homestead prospered well into the twentieth century and as late as 1912 claimed to be the largest steel mill in the United States.[107] Between formation of U.S. Steel and World War II, the Homestead Works saw the expansion of the Armor Plate Press Shop, the construction of three blast furnaces at Carrie, the addition of a new wheel works, a reconstruction and expansion of the structural mill, and two new plate mills. Prior to the Great Depression, then, Homestead underwent its second reconstruction, but the rate and type of construction were not sufficient to maintain the dominant status the works had enjoyed under Carnegie.

IRON

U.S. Steel continued the rebuilding and expansion of the Carrie Furnaces begun under Carnegie's control. Nos. 3 and 4 were blown in early in 1901. Nos. 1 and 2 were rebuilt. Work on Carrie No. 5 was started the following year. Nos. 6 and 7 were completed in 1907. The success of the Neeland raw materials handling system at the Duquesne Works in 1896 lead to a dramatic increase in production.[108] The Carrie Furnaces were brought up to the new levels: No. 3 set a new 24-hour production record of 790 tons in November, 1901.[109]

Several important technical problems challenged furnace operators in the first quarter of the twentieth century. The new ores from the vast reserves of the Masabi Range, though cheap to mine, were very soft and did not descend smoothly through the furnace. The ore also tended to blow out the top of the furnace under the higher blast pressures. Further complicating this problem was the introduction of the by-product coke oven, which produced coke with physical and chemical properties different from those of beehive coke. Its low manufacturing costs would destroy the cost advantage enjoyed by furnaces and steel plants located near the Connellsville beehive ovens, with drastic long-term consequences for the Pittsburgh District.

The solution to the furnace operators' problems included the use of larger hearths, steeper sloped furnace walls, and new charging practices. Due to furnace shell and auxiliary limitations, it was impossible to take full advantage of these innovations until the furnaces were rebuilt. All those at Carrie, except possibly No. 5, were rebuilt between 1925 and 1927. This timing corresponds with the modernization of the structural mills.[110]

This modernization also required the expansion of Carrie's electric generation capacity. Large-scale electric generation first began at Carrie with the construction of the DC powerhouse (later the turbo-generator building) and the AC powerhouse in 1901 and 1906, respectively. These installations would have supplied various auxiliaries in the Homestead Works. A steam-powered turbo-generator was added in 1918 for the 110" plate mill. A second 15,000 kw turbo-generator was needed for the structural mill.

STEEL

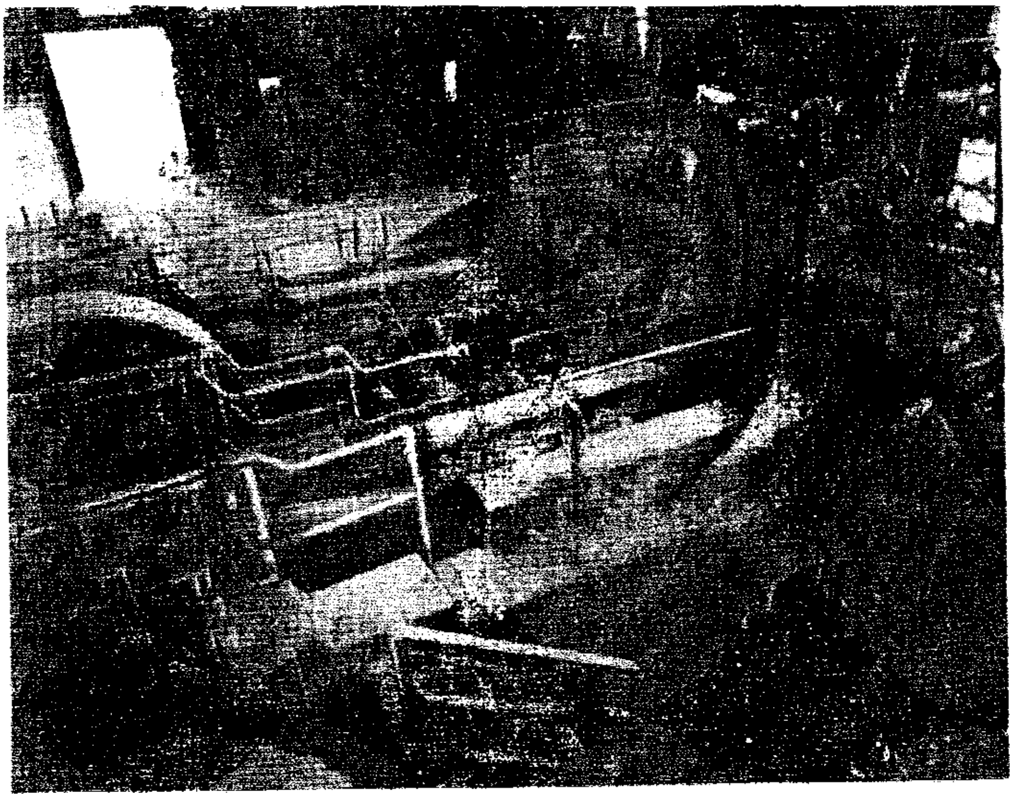
The first quarter of the twentieth century saw the emergence of the basic open hearth as the dominant steel-producing process. In 1907-1908 John Fitch visited Homestead as part of his path-breaking research for the Pittsburgh Survey. He noted:

> The Homestead plant, which made far more Bessemer than open-hearth steel fifteen years ago, operates today sixty open-hearth furnaces, while its two Bessemer converters are idle half the time.[111]

The construction of Open Hearth No. 4 in 1906 and the dismantling of the Bessemers in 1912 completed the changeover at Homestead. Indeed, 1908 was the first year that basic open-hearth production surpassed Bessemer production in the United States. The completion of Open Hearth No. 4 brought Homestead's basic steel capacity to a little over two million tons per year. Open Hearth No. 4 was Homestead's first open hearth with a raised charging platform. The building, constructed on the previous site of workers' housing, took advantage of a slope to support part of the platform. The raised platform improved the product flow through the tapping and teaming aisles. Raised platforms were probably standard practice in 1906; when Duquesne's first open hearth was built in 1900 it was so equipped.[112]

ROLLING MILLS

U.S. Steel greatly strengthened Homestead's position in the steel plate market by constructing four plate mills and remodeling several others. The first, the 140" mill, was built in 1903 on the south end of the 32" slabbing/armor-plate mill, and



Mackintosh-Hemphill's 50" bore x 60" stroke reversing engine for the 48" universal plate mill. Martin Stupich, HAER, 1989.

due to its location was able to speed the flow of production. Between 1911 and 1922 the mill averaged 178,349 gross tons of plate per year. In 1904 the 119" mill was rebuilt as an 84" plate mill — presumably because the 140" mill made the 119" one redundant. A new 72" mill was added in 1907. All of these were steam-powered three-high Lauth-style mills.[113] More research into the history of the plate industry and Homestead's customers is needed to better understand the reasons for these changes. This lacuna is especially unfortunate because rolled plate accounted for the largest portion of Homestead's capacity.

The motivation and timing of the 110", or "Liberty," mill is quite clear. Ordered in April 1917, it was rushed to completion with the help of volunteers in November, so that it could supply plate to the Fleet Emergency Corporation. It was Homestead's first electric-drive and Carnegie Steel's first electric plate mill. Its 4,000-hp three-phase motor was powered by a generator driven by a blast-furnace-gas engine installed at the Carrie Furnaces.[114]

Research done in conjunction with the recent disassembly and preservation of the 48" mill and reversing engine indicates that the mill underwent major changes about 1930. Apparently its stand was replaced and upgraded to a maximum plate width of 52". The original spur gears of the pinion stand were replaced with herringbone gears, which allowed the mill to run more smoothly. In this case, the reason for the timing is unclear.[115]

The tremendous growth of the automobile industry in the 1910s and 1920s foreshadowed its emergence as the dominant steel consumer. The steel industry developed the four-high high-speed strip mill to meet the demand for large tonnages of very flat, accurate-gauge steel for automobile bodies. The increasingly higher standards in the steel strip market caught up to the plate market, making even the relatively new 110" mill obsolete. It is likely that it was the need to upgrade its facilities so as to maintain its market share that motivated U.S. Steel to begin work on a new $10,000,000 plate mill at Homestead during the Depression. The new 100" semi-continuous plate mill featured seven mill stands, including a four-high reversing rougher and four four-high finishing stands. Two features of the mill are of special note. The roughing stand, claimed by its manufacturer to be the first four-high reversing mill installed in a multistand, or tandem mill, was equipped with electronic systems to preset the rolling schedule and control the gauge. The plate shears were equipped with special knives that cut the steel to length with a unique rocking motion in order to reduce bowing in the plate. Both these features were later judged as ineffective and were replaced. In 1937 the mill had a rated annual capacity of 729,000 gross tons. The 110" mill was shut down shortly after the 100" mill went into operation and the former's buildings were incorporated into the 100" mill complex.[116]

In 1924 U.S. Steel announced its intention to modernize Homestead's structural mills; work on the site began in 1926. In place of seven steam-powered blooming and finishing stands in three groups, U.S. Steel installed seven electrically powered stands arranged in two groups under a single roof. No. 1 Structural rolled all the standard sections of old mills, while No. 2 Structural rolled U.S. Steel's version of the wide-flange or Grey beam. This required a building covering 26 acres and about 1,000 tons of structural steel per acre. It also required a remarkable feat of engineering *legerdemain* to construct the new mills on the site of the old ones without interrupting production.

The rolling schedule for No. 2 Structural required a 54" blooming mill — probably the largest size ever built. In 1927, the superintendent for electricity at Homestead described the 54" mill's drive as "the largest reversing motor in the world [and] has a continuous rating of 8000 H.P. at 40 R.P.M. and a maximum torque of 3½ million pounds feet." When a duplicate of the 54" mill was installed at the South Chicago Works the company replaced the motor and the pinion stand with the first dual-motor drive system ever installed in a steel mill.[117]

Several features distinguished the No. 2 structural from the Grey mill at Bethlehem. The most important were parallel flanges and variable speed motors. Parallel flanges increase the strength of the beam and are simpler to fabricate than the Grey mill's tapered flanges. The beams were rolled with the flanges flared until the final finishing pass. At least as late as 1926 Bethlehem was rolling its Grey beams with tapered flanges — although the slope was very slight. The individual variable-speed motors permitted the adjustment of the roll speeds to compensate for the differing roll diameters. This was not possible on the original Grey mill because the edge and the web passes were mechanically linked to the same steam engines. Nevertheless, the Homestead contributions were incremental innovations.[118]

By the 1920s Homestead had clearly lost its dominant position in the structural steel trade. Where it had once commanded about 49 percent of the national market, all of Allegheny County now commanded only 31 percent. The reasons for this decline can be reduced to: 1) obsolete equipment, 2) geographical shifts in the steel industry, and 3) Bethlehem's control of the Grey mill patents. The cost of operating the old mills, with their decentralized boilers, was, in the words of the superintendent of Homestead's electrical department "out of proportion to the tonnage which they could ever be expected to produce." U.S. Steel installed a structural mill at the South Chicago Works shortly after its formation in order to reduce shipping costs to Midwest markets from Homestead. To the east of Homestead, Lackawanna and Bethlehem entered the trade in 1901 and 1908, respectively. The combination of its close proximity to New York City and its exclusive control of the Grey beam allowed Bethlehem to develop the largest structural capacity in the country by 1920. Thus the new structural mills at Homestead can be seen as a belated attempt by U.S. Steel to reassert its presence in the eastern structural markets.[119]

Structural steel had, however, become an extremely important profit center to Bethlehem — especially after the Washington Conference severely crippled its ordnance production. As mentioned above, Judge Gary sought to tread a careful line between monopoly and competition for the sake of stable production and profits. To Bethlehem this meant staying out of each other's markets: to U.S. Steel this meant taking the lead. In 1928 Bethlehem sued U.S. Steel for patent infringement. An out-of-court settlement was reached the following year, with U.S. Steel agreeing to pay royalties. Royalty payments on top of the already higher shipping costs to east coast markets would only have further weakened Homestead's position. Of the numerous countercharges brought by U.S. Steel, the most important one appears to be that the patents were invalid because Grey had patented the work of others. There can be no question that many had worked on the development of a wide-flange mill, but in lieu of making an exhaustive study of the patents or a legal judgement, it would be unwise to draw further conclusions on the merits of the case.[120]

Several other rolling processes should be mentioned here in passing. As noted above, the manufacture of axles was begun at Homestead shortly before the formation of U.S. Steel. By 1906 a 10" guide mill was installed near the 23" structural finishing mill. By 1908 Homestead was manufacturing bolts and rivets, possibly from steel rolled on the 10" mill. By 1916 there was a 16" billet train and a 12" bar mill and Homestead is listed as having an annual capacity of 24,000 tons of rounds and squares. Steel railroad ties for mines, trolleys and other uses were also rolled at Homestead during this period.[121]

In 1908 the company both bought the Schoen Steel Wheel Company located in McKees Rocks and installed the Slick wheel mill in the armor plate deck shop. Homestead developed its own version out of these two processes: a version of Slick's bloom shear was used to cut blanks for pre-forming under a closed die forging press; the blanks were finished on Schoen's wheel mill. About 1918 E.E. Slick, developer of the Slick process, became vice-president and general manager of the Midvale Steel & Ordnance Co., and installed the process at the Cambria Steel Works.[122]

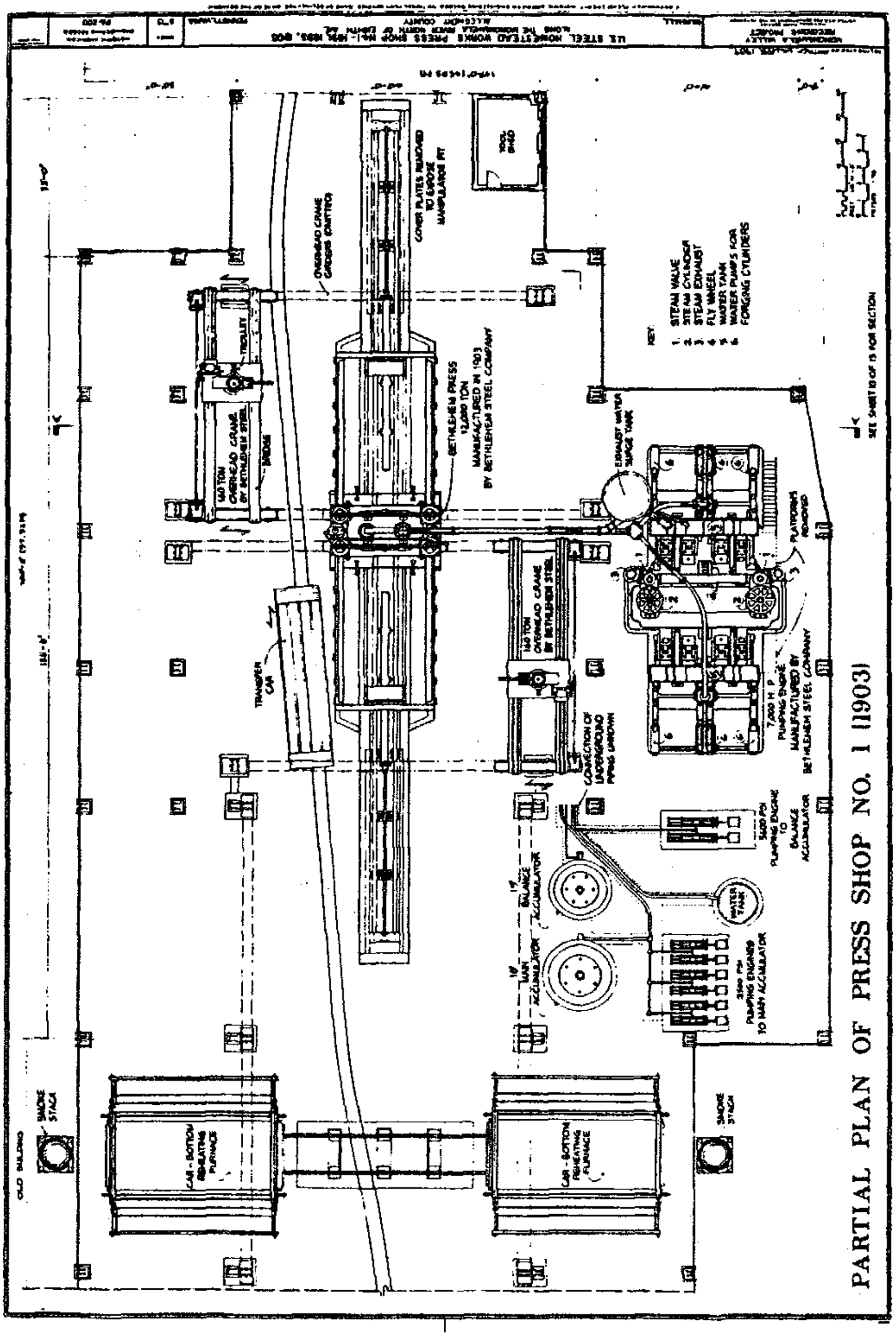
FORGING

The Armor Plate Department was expanded in 1903. In November 1900, just weeks after staunch naval-power supporter Theodore Roosevelt was elected President, both Bethlehem and Carnegie contracted to produce more armor plate than their combined capacities. The Navy insisted that the companies increase their capacity in order to complete the contracts on time. Likewise Eugene Grace, president of Bethlehem Steel, was to recall later that in 1902 armor producers were "specially requested — almost commanded — to increase, or to double, rather, our producing capacity. . ." At Homestead this was done quite literally: a second forging press, a second machine shop, and the Harvey Shop were expanded. The new forging press was manufactured by Bethlehem Steel with a 12,000-ton rated capacity and was the result of the combined experience of Whitworth, Bethlehem, and Homestead. Like the old Whitworth press at Homestead, the new Bethlehem press used Whitworth's control patents and a virtual copy of the pumping engine that powered the Whitworth press. The design of the press itself was based on the work of John Fritz and Russell Davenport for Bethlehem's 14,000-ton forging press. In the absence of documentary evidence it is only speculation to suggest that Homestead's contribution to the design of the plant was to specify a copy of the existing pumping engine (perhaps as a means to control maintenance costs) and a 12,000-ton press, instead of the 14,000-ton press at Bethlehem. The No. 2 Machine Shop, constructed to the west of the press shop, was approximately 40 percent larger than the existing one. The Harvey Shop was doubled in length.[123]

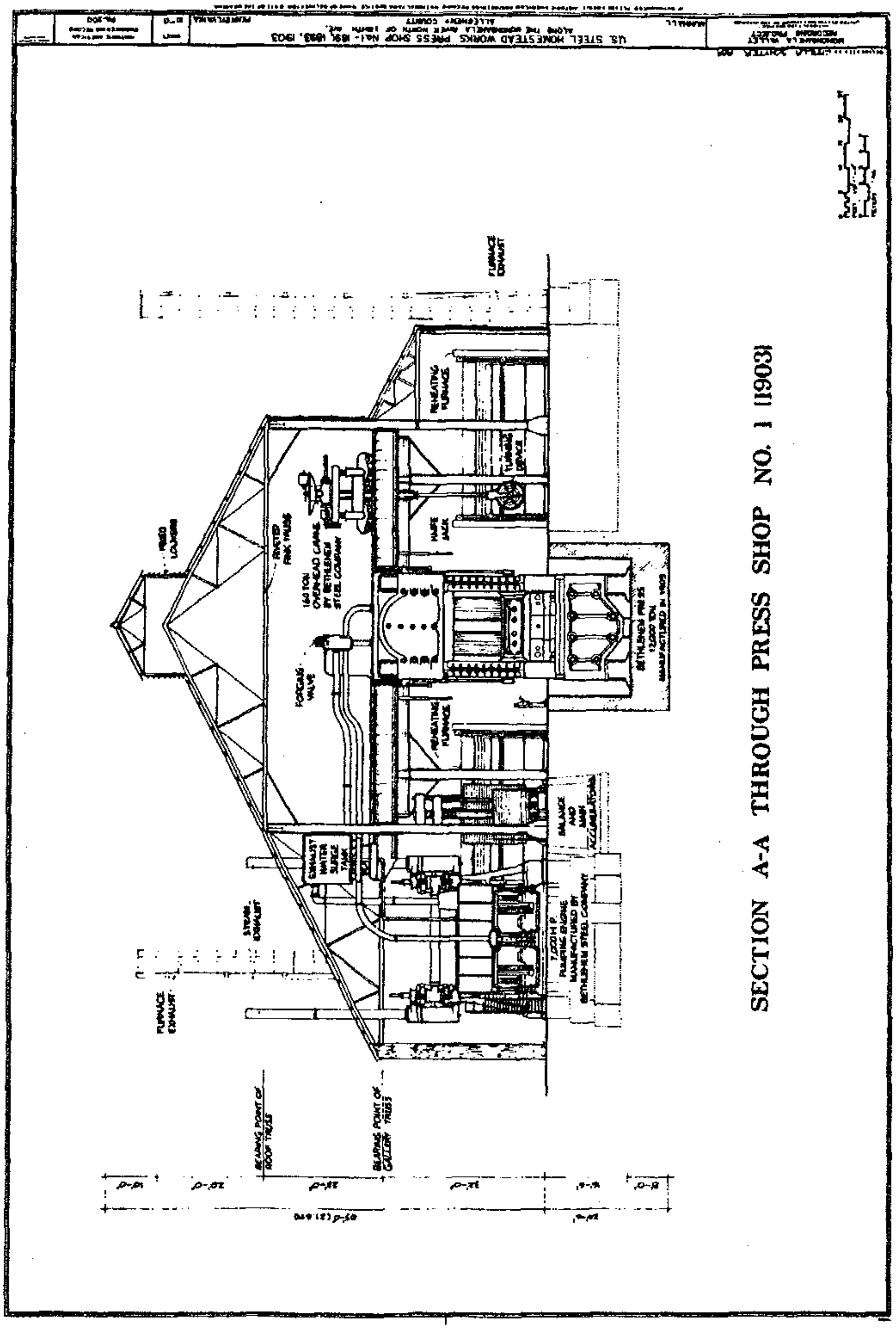
The issue of armor prices reemerged after the Spanish-American War. A group of vocal legislators fought for a government armor plant to serve as a check on the armor producers. At the same time the Midvale Steel Company was seeking a share of the armor market. While initially rebuffed by the Navy — despite having submitted lower bids — Midvale eventually was able to join Bethlehem and U.S. Steel as a major armor manufacturer. In 1916, on the threshold of world war, Congress authorized the Navy to construct or purchase an armor plant. The offer of free land contributed to the decision to construct the government plant in South Charleston, West Virginia. Armor production at South Charleston did not begin until 1921 because of construction lead time and production priorities that favored the manufacture of projectiles and small caliber guns over armor production. Just after South Charleston began making armor, diplomatic developments forced the Navy to mothball the plant.

In November 1921, the United States invited six major European powers, as well as China and Japan, to consider both the limitation of naval armaments and the settlement of various territorial issues in the Far East. The resulting naval armaments treaty limited the size and number of capital ships for each of the naval powers, the United States, Great Britain, France, Italy, and Japan. It also established a ten-year moratorium on new construction and required the scrapping of 66 ships.[124]

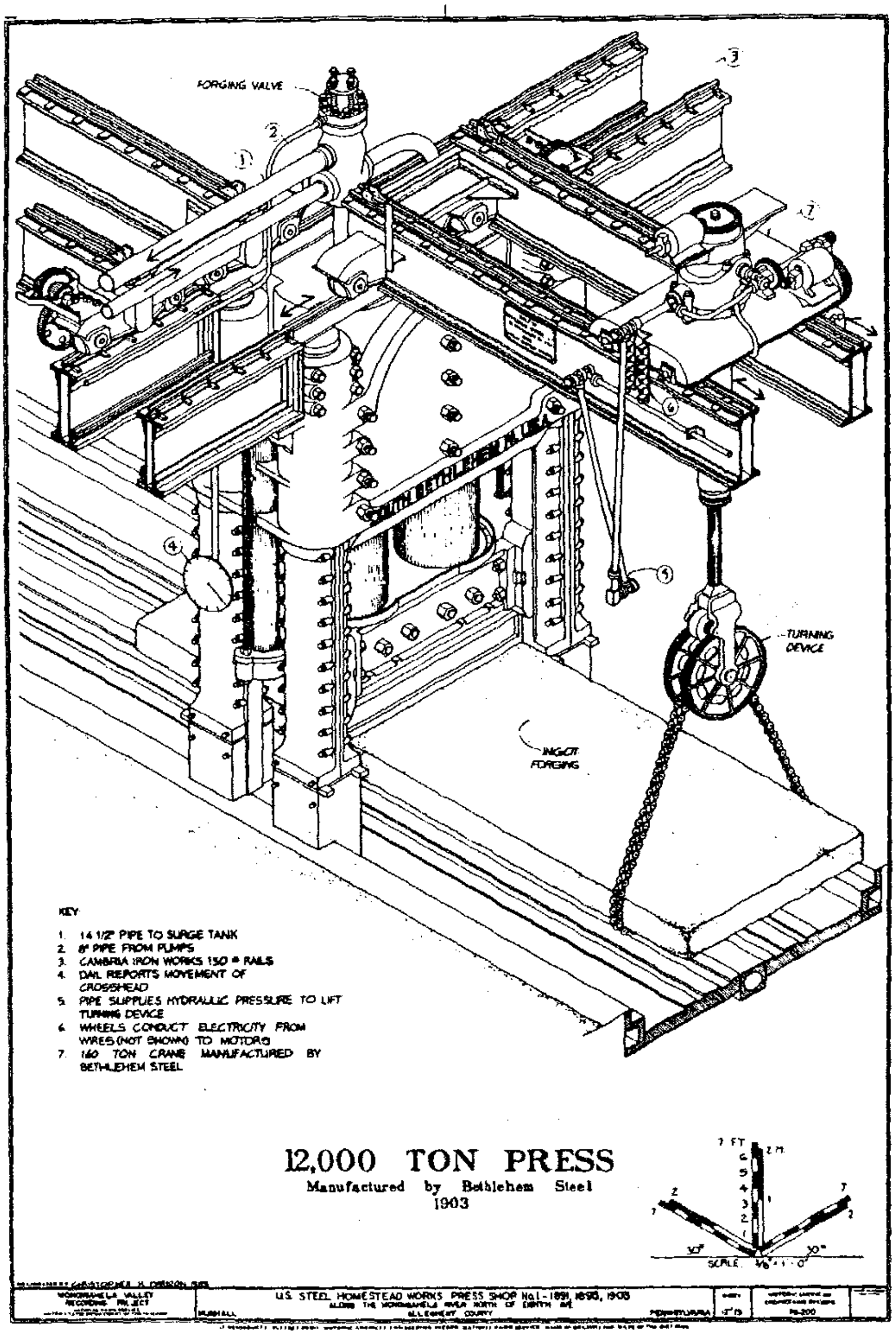
During World War I, the Armor Plate Division at Homestead presumably had seen much activity. The signing of the naval armaments treaty put the division into a deep coma, since Homestead had not yet become active in the commercial forging business. Indeed, the 1926 *Iron and Steel Works Directory* reported the department



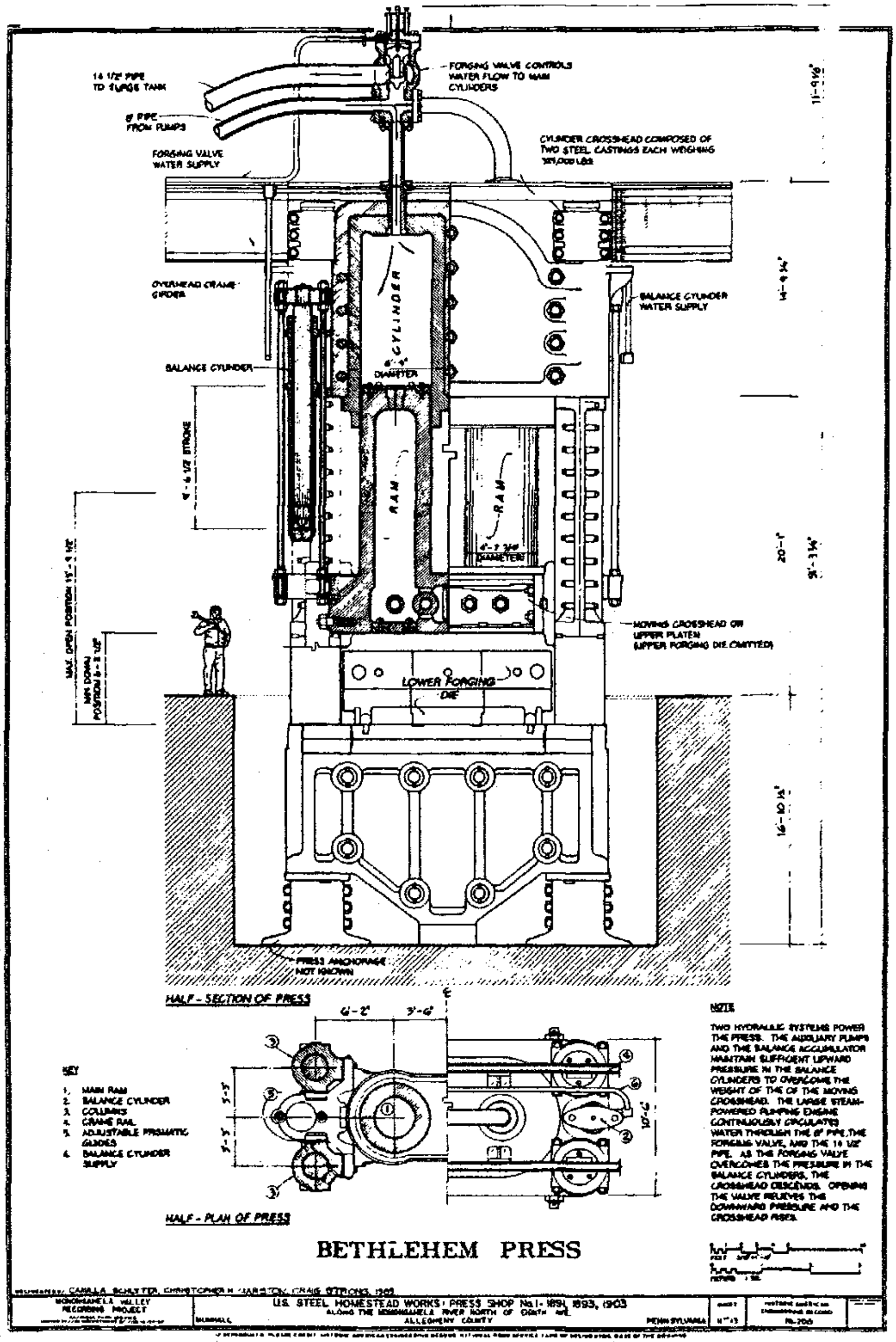
Plan of Homestead Press Shop No. 1 (1903), Craig Strong and Christopher Marsten, delineators, HAER, 1991.



Section of Homestead Press Shop No. 1 (1903), Craig Strong and Christopher Marsten, delineators, HAER, 1991.



12,000 ton Bethlehem Steel press at Homestead, Craig Strong and Christopher Marsten, delineators, HAER, 1991.



Half plan of 12,000-ton Bethlehem Steel press at Homestead, Craig Strong and Christopher Marsten, delineators, HAER, 1991.

as discontinued. At some point the Whitworth press cracked its forging ram and was not repaired. It was scrapped in 1934 — just a few years before the World War II buildup would have made repairs extremely cost efficient.[125]

AUXILIARIES

The electrification of American steel mills that began in the 1890s was complete by World War II. While auxiliaries were the main focus of mechanical and electrical development in the nineteenth century, the primary focus of the early twentieth century was the electrification of main mill drives. Homestead was no longer a pioneer. Edgar Thomsom had installed the first electric rail mill in 1903 and the Gary Works was designed to be fully electric from the beginning. The 110" mill was the first electric-drive plate mill constructed by the Carnegie Steel Co., but, as we have seen, it was not the first constructed by U.S. Steel. Many of the conversions were as simple as replacing a steam engine, such as one powering a roll table, with an electric motor. In 1921 Homestead conducted an experiment that replaced the steam engine that powered the finishing stand of the 33" structural mill with a 4,000-hp AC motor. The success of the experiment undoubtedly reinforced the decision to give electricity an important role in plans to modernize the entire structural department.[126]

Electric motors offered several important advantages to mill operators, including centralization of boiler plants, faster and cheaper material handling, higher operating efficiency, and lower maintenance costs.[127]

The new structural mill required that a central powerhouse replace the numerous boiler plants located throughout the works. Special motor rooms were constructed to protect the large mill motors and their supporting current conversion and control systems. The first of the motors rooms built at Homestead was a freestanding brick structure within the 110" mill. The 44" and 54" blooming mill motors were protected by a similar structure with a steel plate roof. An overhead crane that serviced other equipment could remove the plate to service the motors. The motor room for the structural finishing stands and for the 100" mill followed the now ubiquitous pattern of independent buildings with their own overhead cranes and windows.

LABOR

In the United States, the period between the formation of U.S. Steel and World War II saw first the rise and decline of corporate paternalism and then, in the 1930s, with the encouragement of New Deal legislation, the organization and recognition of the Steel Workers Organizing Committee (SWOC).[128] The shift of the focus of Homestead's civic life from one of labor to one of capital is perhaps best represented by the rise of corporate paternalism. U.S. Steel, like many other companies, developed welfare programs to stabilize the work force and reduce the appeal of unionization. As Curtis Miner has suggested, initial efforts, begun in the Carnegie era, included civic improvements like the establishment in Homestead of the Carnegie Library, Frick Park, and Schwab's manual training school. U.S. Steel introduced modest stock-ownership, accident, health, pension and death benefits specifically for workers in the mill. After the Pittsburgh Survey spotlighted conditions in the industry and town, the company broadened its efforts to include financial support and assistance for playgrounds, organized sports, citizenship classes, and churches.

These programs tended to reinforce the company's position by drawing attention away from working conditions and by encouraging close relations with religious leaders. By the mid-to-late 1920s, however, the company began to retreat from these community programs. Miner suggests that this happened because U.S. Steel's diversification and expansion made it less dependent on local community attitudes. The company also maintained close ties with the borough councils by filling the void left by the collapse of the Amalgamated in 1892. Whereas previously union members had dominated the local elected offices, these offices were now held by company managers and middle-class merchants who had a financial interest in seeing that civic authority was not exercised by people unfriendly to the company.

Between 1890 and 1940 Homestead borough saw a 236 percent population increase. The greatest growth, in terms of real numbers, took place in the early twentieth century, as was generally true of northern industrial centers. Between 1900 and 1910 the vast majority of the newcomers were Slovak immigrants: foreign-born residents increased from 3,604 to 7,068, or 196 percent. Between 1910 and 1920, and more particularly during World War I, the majority of newcomers were Blacks from the deep South; with the Black population increasing from 867 to 1814, indeed 209 percent. The latter trend continued, though at a somewhat slower pace, during the 1920s because postwar immigration restrictions stemmed the flow from Europe. As might be expected, both groups were recruited as cheap unskilled labor.[129]

World War I not only interrupted the supply of Eastern-European labor but created a labor shortage. This turn of events would have several important long-term consequences. Industry and the federal government agreed to partial recognition of organized labor in return for labor's cooperation during the emergency. The return of the troops, however, created a labor glut and weakened organized labor's position. The result was the Great Strike of 1919. Once again state law enforcement officers patrolled the streets of Homestead. The outcome turned out to be Pyrrhic victory for capital, because public pressure resulting from investigations of the strike led to the introduction of the eight-hour day.

Research into the history of SWOC is still in its infancy. Nevertheless what has been done suggests that Homestead was particularly slow to organize. David Brody has suggested that

> a long and sobering experience with trade unionism had given the steelworkers a healthy respect for the power of their employers. With memories of the 1919 steel strike still fresh in their minds, they held back until it was abundantly clear that SWOC would win in the end.[130]

It appears that this was doubly so for Homestead. Even after U.S. Steel recognized SWOC in 1937, Philip Murray reportedly said "we have a contract but no local [at Homestead]."[131]

The Defense Plant: 1941-1945

> The Navy has determined that no other concern is in a position to provide the facilities and increased production within the time limits required.
>
> -Frank Knox, Secretary of the Navy
> to William S. Knudson,
> Office of Production Management,
> June 23, 1941.[132]

World War II drove Homestead out of its economic and technological doldrums. In the spring and summer of 1939, while Germany and the Soviet Union were negotiating their non-aggression pact, the Navy moved to rehabilitate the South Charleston, West Virginia, ordnance plant. Closed since the Naval Armaments Conference of 1921, the South Charleston plant was placed under Homestead management. A formal lease was signed in January 1940. While the history of the South Charleston plant is outside the scope of this paper, it is important to note that Homestead made much of the steel that South Charleston forged (with three 14,000-ton presses), heat treated, and machined. By 1943 the combined monthly capacity of the two armor plants was 6,700 gross tons.[133]

In its institutional history, the Navy Bureau of Ordnance refers to the devastating effect of the Washington Naval Conference on American expertise in armor production and notes:

> Except for one man in the Homestead plant of Carnegie-Illinois, a subsidiary of United States Steel, the chief personnel familiar with the actual mill techniques were all lost to the industry.[134]

Recent research suggests that the Navy's emergency research and development of face-hardened armor was wasted. Between the two world wars developments in projectile technology rendered face-hardening ineffective.[135]

In the summer of 1941, as the threat of war in the Pacific continued to mount, U.S. Steel and the Navy agreed to a major expansion of production facilities at the Edgar Thomson, Duquesne, and Homestead works. The largest of these expansions, in fact the largest expansion of an existing steel facility in the nation, was at Homestead. The Defense Plant Corporation financed the $90,000,000 expansion of the Homestead Works to supply the urgent need for steel plate, both forged and rolled, and ship shafting. After sixty years of growth and expansion, there was no possibility of expansion within the existing mill property. The only remaining level land in Homestead was to be found in the first and second wards. Generally known as the Ward, the area bounded by the Howard Axle Works, the river, the Armor Plate Department, and the railroad tracks was a residential and commercial district of 6,500 to 8,000 people. Clearing the site for the defense plant required razing over 1,200 buildings and moving the Howard Axle Works to McKees Rocks. The entire site of 120-plus acres was not completely acquired until 1942; to acquire the land county officials and the company made patriotic appeals, depicted the Ward as a slum, and threatened seizure under eminent domain.[136]

The Defense Plant Corporation constructed eighty buildings consisting of a fifth open-hearth plant, a 45" universal slabbing mill, a 160" plate mill, a second forge shop, a machine shop, and numerous support structures. Open Hearth No. 5

consisted of eleven 225-ton oil-fired furnaces with an annual capacity of 1,700,000 tons. The 45" slabbing mill was equipped with dual motor drives for the horizontal rolls. The 160" mill was a four-high sheared plate mill designed to roll wide ship plate. This was the first use of dual-motor drive for a plate mill in the United States. The No. 2 Press Shop featured a 7,000-ton hydro-pneumatic press in a shop layout based on South Charleston's. The new press shop was rated at 17,000 tons of armor forgings and 5,000 "special forgings" (presumably shafting) per year.[137]

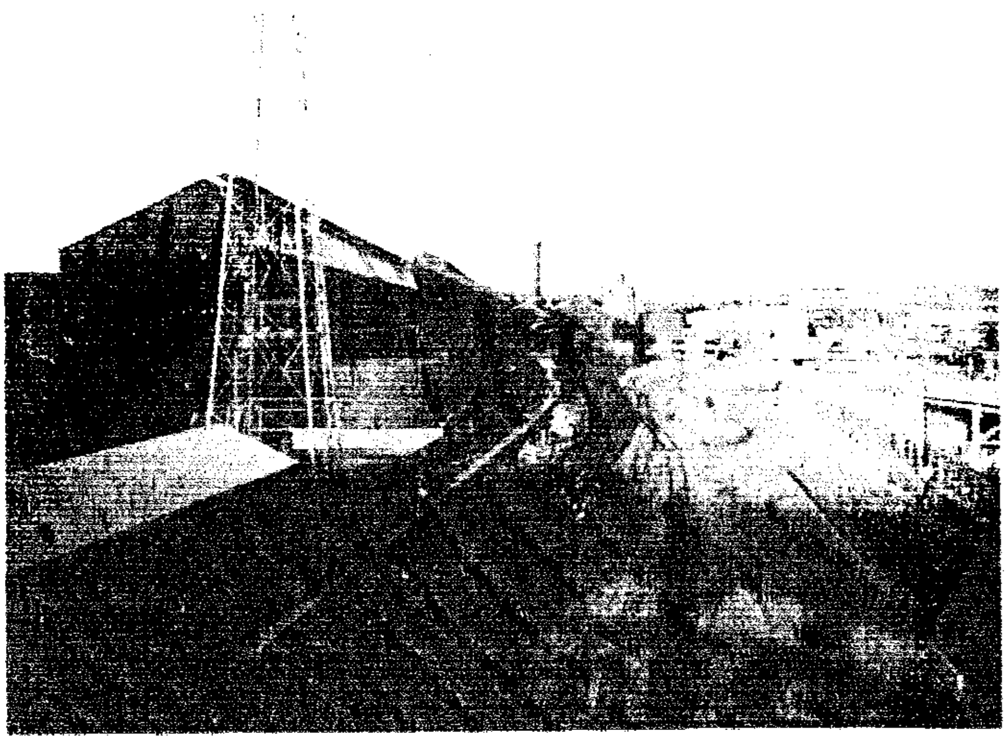
It is unclear why a 7,000-ton press was built instead of some other capacity. The new press certainly forged ship shafting for machining in the adjacent Machine Shop No. 3, and would not need a greater capacity. Given the presence of a 12,000-ton press in the No. 1 shop and three 14,000-ton presses at South Charleston, the No. 2 press may have been intended for smaller gauges of armor. The open hearth and the forge went into production in 1943 and the rolling mills followed the next year.[138]

Under a separate contract, the Navy also constructed a building for heat treating a type of homogeneous structural steel plate called Special Treatment Steel or S.T.S. An ultra-service, high-tensile steel, S.T.S. was developed to conserve scarce alloys. After the War, Homestead produced a commercially successful version of S.T.S. known as T-1 steel. For a brief period starting in 1945, the Mingo Works at Mingo Junction, Ohio, was placed under Homestead's management. While little is currently known about its role, the Mingo Works heat treated and finished light armor deck plate starting in 1940.[139]

The company also embarked on several important expansions at the Carrie Furnaces with its own capital. Both Carrie No. 3 and No. 4 were rebuilt in 1941-42 from 21-foot to 26-foot hearths. A new power house, featuring a 40,000 kva turbo-generator, was constructed to supply electricity to the defense plant.[140]

Unfortunately the lack of production figures makes it very difficult to demonstrate the extent of Homestead's achievements during what was unquestionably its peak years. Nevertheless, a few cautious statements can be made from the figures that have escaped the censors and the company's wariness (no doubt partially conditioned by its experiences with the 1894 armor-plate scandal). In 1946, Homestead had about 12,000 employees, at least 2,000 of whom were women. If we make the more than reasonable assumption that Homestead was producing at, or somewhat over, rated capacity, then the figures in the *Iron and Steel Works Directory* (see table) before and after the war are good estimates of actual production. When it came on line, Open Hearth No. 5 represented a 66-percent increase in steelmaking capacity. At a 1943 rated capacity of 6,700 gross tons of forged armor per month, the combined annual production of Homestead and South Charleston could have approached 80,400 tons — more than three-and-one-half times Homestead's pre-Washington Conference capacity. Excluding South Charleston's massive facilities, Press Shop No. 2 added 22,000 tons to Homestead's 1938 rating. While such slogans as "Victory Valley," "Arsenal of Democracy," and "Forge of the Universe" must, in light of the accomplishments of Bethlehem and Midvale, be regarded as local boosterism, they do suggest the scale of Homestead's contribution.[141]

U.S. Steel purchased the defense plant after the war for $63,000,000 or the rough equivalent of the construction costs less leasing fees. While the bidding for



Part of the Defense Plant, left to right, Open Hearth No. 5, south cinder yard, and the No. 2 Press Shop. Jet Lowe, HAER, 1989.

the defense plant was theoretically open to any company, the mixed nature of the facilities at Homestead made it impractical for any company other than U.S. Steel to operate them. Although not representing any major technological innovations, the sheer size of the defense plant construction substantially modernized Homestead. With the exception of the 48" mill and the No. 1 press, all of Homestead's older mills and open hearths were shut down in the postwar years. The war solved the longstanding overcrowding problem and modernized the works in five years — something that disadvantageous freight rates and property owners unwilling to sell their land made impossible under peacetime conditions. Homestead would not again undergo such dramatic change until the shutdowns of the 1980s.[142]

Notes

1. The research and much of the writing for this article was conducted for the Historic American Engineering Record (HAER), a division of the National Park Service, as part of its documentation of the steel industry in the Monongahela Valley. Colleagues and supervisors in the Homestead, Pennsylvania, field office, and the Washington, D.C., headquarters have made invaluable contributions to this work. The Steel Industry Heritage Task Force served as HAER's local sponsor. The Park Corporation of Cleveland, Ohio, granted access to the site and to its massive drawing collection. The faculty of the Henry Clay Frick Department of Fine Arts at the University of Pittsburgh have been most patient. Thomas E. Leary and Elizabeth C. Sholes prepared an invaluable annotated bibliography. Thanks are also due to many colleagues and to former employees of U.S. Steel, including Clifton Ames, Lloyd Fenstermaker, William Gaughan, Raymond Hornak, Lance Metz, William Serrin, and the 1892 Centennial Committee. Special thanks to Fannia Weingartner.
2. Joseph Frazier Wall, *Andrew Carnegie* (New York: Oxford University Press, 1970; repr. Pittsburgh: University of Pittsburgh Press, 1989), 475.
3. James H. Bridge, *The Inside History of the Carnegie Steel Company* (New York: Aldine Book Co., 1903; repr. New York: Arno Press, 1972), 87, 150-153; most accounts follow Bridge: Wall, *Carnegie,* 474-477; Paul L. Krause, "The Road to Homestead" (Ph.D. diss., Duke University, 1987), 346-348; Allegheny County Recorder of Deeds Office, Limited Partnerships, vol. 2, 51-52; "That New Steel Works", *Pittsburgh Commercial Gazette*, October 14, 1879, 4. In addition to Bridge and Wall, see John M. Lenhart, "Andrew Kloman, Founder of the Carnegie Steel Company," *Social Justice Review*, May 1943, 58-60, for more on Andrew Kloman. Thomas J. Misa, "Science, Technology and Industrial Structure: Steelmaking in America, 1870-1925" (Ph.D. diss., University of Pennsylvania, 1987), 223-225, has a description of the Kloman eyebar.
4. Allegheny County Recorder of Deeds Office, Deed Book, vol. 353, 497-500 and Deed Book, vol. 402, 29-30.
5. "The Homestead Steel Works," *Engineering and Mining Journal* 37, no. 24 (June 14, 1884), 446. The American Iron and Steel Institute, *Steel Works Directory,* hereinafter cited as *Iron and Steel Works Directory*, shows the convertors were rebuilt to 5-ton capacity each by 1890, a modernization that could have altered the original layout.
6. Jean McHugh, *Alexander Holley and the Makers of Steel* (Baltimore and London: Johns Hopkins University Press, 1980), 347-348; Paul Lewin Krause, "The Road to Homestead" (Ph.D. diss., Duke University, 1987), 351-359; Henry Marion Howe, *The Metallurgy of Steel* (New York and London: The Scientific Publishing Co, 1890), 331. A description of the converting plant was also included in the 1886 charter of Carnegie, Phipps, and Co. In his *Iron and Steel in Nineteenth-Century America: An Economic Inquiry* (Cambridge, Mass.: The M.I.T. Press, 1964), 180-182, Peter Temin argues that the patent restrictions gave Pittsburgh Bessemer a cost disadvantage and were made without the benefit of Holley's participation. Howe, recipient of the Bessemer Medal, would seem to take issue (as does Krause) with Temin's conclusion that Homestead was an inferior installation. Temin was correct in suggesting that the restrictive policies of the Bessemer Steel Company contributed to Pittsburgh Bessemer's failure. This was not because the plant design was inferior, but because the established Bessemer rail companies were the only source of experienced nonunion labor. Obviously, none of these companies thought they had an interest in the survival of Pittsburgh Bessemer. As Krause points out (p. 362), it is one of the numerous ironies that surround Homestead that, by not aiding Pittsburgh Bessemer during the 1882 strike, Carnegie strengthened the Homestead locals — something that would haunt him in 1889 and 1892.
7. McHugh, *Holley,* 342; Ralph Crooker, Jr., "The Development of the American Blooming Mill," *Proceedings, Engineers' Society of Western Pennsylvania* 13 (1897), 325-339; Krause, "Road to Homestead," 357, n. 17; quotes from Crooker, "American Blooming Mill," 336. The reversing engine was probably the 1662-horsepower 28"-bore x 48"-stroke horizontal duplex non-condensing reversing engine still in use as late as 1925. The original blooming mill itself was probably replaced in 1894. See Carnegie Steel Company, *Homestead Steel Works Plant Description Book,* 1925, in the collection of the Park Corporation, West Homestead, Pa.: 159, 162.
8. Lenhart, "Kloman," 60; "Articles of Association, Carnegie, Phipps and Co.", Allegheny County Recorder of Deeds Office, Limited Partnership Book, vol. 4, 265; Bridge, *Inside History of Carnegie Steel,* 151; Allegheny County Recorder of Deeds Office, Deed Book, vol. 406, 540-543 and Deed Book, vol. 406, 551-553; Crooker, "American Blooming Mill," 336; "Amended

Articles of Association, Pittsburgh Bessemer Steel Co.," Allegheny County Recorder of Deeds Office, Limited Partnerships, vol. 2, 166-169.

9. *Iron and Steel Works Directory* (1884), 119; Krause, "Road to Homestead," 361, n. 1; Wall, *Carnegie*, 476; *American Manufacturer and Iron World*, 33, no. 16 (October 19, 1883), 10.

10. Bridge, *Inside History of Carnegie Steel*, 152-160; Wall, *Carnegie*, 286-288; Krause, "Road to Homestead," 388-423; Temin, *Economic Inquiry*, 180-181; untitled article *American Manufacturer* 33 (October 19, 1883), 10; "Sale of Pittsburgh Bessemer Steel Works," *Iron Age* 32 (October 18, 1883), 14; Bruce E. Seely, "William Henry Singer," *Iron and Steel in the Nineteenth Century*, Paul F. Paskoff ed. (New York: Facts on File, 1989), 314.

11. "The Homestead Steel Works," *Iron Age* 42 (November 1, 1888), 657.

12. Kenneth Warren, *The American Steel Industry, 1870-1970: A Geographical Interpretation* (Oxford: Clarendon Press, 1973; repr., Pittsburgh, Pa.: University of Pittsburgh Press, 1988), 177.

13. "The New Open Hearth Plant of the Carnegie Steel Company, Limited," *Iron Age* 61 (June 30, 1898), 12.

14. "The Activity in Building Open-Hearth Plants," *Iron Age* 37 (June 3, 1886), 20; "The Lash Steel Melting Furnace," *Iron Age* 40 (September 8, 1887), 1; *Iron and Steel Works Directory* (1890), 118; *Iron and Steel Works Directory* (1916), 84.

15. *Iron and Steel Works Directory* (1916), 84.

16. *Iron and Steel Works Directory* (1890), 118; Carnegie Steel Company, *Views in Homestead Steel Works* (Pittsburgh: Carnegie Steel Co., 1895).

17. "The New Open Hearth Plant of the Carnegie Steel Company, Limited," *Iron Age* 61 (June 30, 1898), 12-14.

18. *Iron and Steel Works Directory* (1898), 117.

19. William T. Hogan, *Economic History of the Iron and Steel Industry in the United States* (Lexington, MA.: Heath, 1971), 402.

20. Samuel T. Wellman, "Early History of the Open Hearth Steel Furnace," republished in Victor Windett, *The Open Hearth* (New York: U.P.C. Book Company, nd.), 29-47.

21. "Manufacturing Notes," *American Manufacturer and Iron World*, 38 (April 23, 1886), 7.

22. Temin, *Economic Inquiry*, 142-145.

23. Misa, "Science, Technology," 217.

24. Ibid., 220-222.

25. Temin, *Economic Inquiry*, 147-152.

26. McHugh, 342, 358-359; Wall, *Carnegie*, 502-503; Temin, *Economic Inquiry*, 183-185. Temin's date of 1883 for basic open-hearth steel at Homestead is probably a typographical error.

27. See also David. B. Sicilia, "Samuel Thomas Wellman," in *Iron and Steel in the Nineteenth Century*, Paul F. Paskoff ed. (New York: Facts on File, 1989), 361.

28. Misa, "Science, Technology," chapter IV; quote p. 220. That Homestead used Bessemer steel for structurals is clear. The Bessemers were dismantled at Homestead in 1912 (*Iron and Steel Works Directory*, 1916: 84). After 1887, rails, the traditional use of Bessemer steel, were not a major product at Homestead. Homestead's Bessemers, therefore, had to be used for either plate, armor plate, or structurals. The Navy required open-hearth steel for armor plate. An 1889 description of the works, co-authored by General Superintendent J.A. Potter, reports that Bessemer ingots are rolled on the 23" blooming mill and then taken to the structural mills for finishing. Open-hearth ingots were slabbed on the 32" mill and then rolled on the 119" plate mill. (W. Richards and J.A. Potter, "The Homestead Steel Works" *Proceedings of the United States Naval Institute* 15, no. 3, 1889: 431-441.) This is confirmed by the mill's geography. The structural mills were located next to the converter building. The plate mills were built nearest the open-hearth buildings. Kenneth Warren, *American Steel Industry*, 177, reports that Cambria Steel built up its structural steel business in the 1890s using Bessemer steel. It is also interesting to note that the 1901 *Iron and Steel Works Directory* reported that "[rolled structural material] has been a leading factor in the development of our open-hearth steel industry and in the enlargement of our Bessemer steel industry beyond the production of rails." (p. xi)

29. "New Open Hearth," *Iron Age* 61 (June 30, 1898), 12-14; John A. Fitch, *The Steel Workers* (New York: Russell Sage Foundation, 1910; repr., Pittsburgh: University of Pittsburgh, 1989), 44.

30. "Hot Metal from Duquesne to Homestead," *Iron Age* 61, (June 9, 1898), 30; "Hot Metal from Rankin to Homestead," *Iron Trade Review* 33, no. 43 (October 25, 1900), 15.

31. Ambrose Monell, "A New Basic Open-Hearth Process," *Iron Trade Review* 33, no. 22 (May 31, 1900), 13-15; F.W. Harbord and J. W. Hall, *The Metallurgy of Steel* (London: Charles Griffen & Co., 1911, fourth edition), vol. I, 203-204.

32. *Iron Age*, October 18, 1883, 14.

33. *Iron and Steel Works Directory* (1886), 105-106.

34. *American Manufacturer and Iron World*, 41, no. 20 (Nov. 18, 1887), 7; Richards and Potter, "Homestead Steel Works," See also Warren, *American Steel Industry*, 102; and *Iron and Steel Works Directory* (1890), 118.

35. *American Manufacturer and Iron World*, 41, no. 20 (Nov. 18, 1887), 7; Richards and Potter, "Homestead Steel Works," 435. See also Warren, *American Steel Industry*, 102; and *Iron and Steel Works Directory* (1890), 118.

35. *Iron and Steel Works Directory* (1886), 105; *Iron and Steel Works Directory* (1890), 118. The 1886 *Iron and Steel Works Directory* mentions a 32" structural train, but it is probably the 33" train mentioned in the 1890 *Iron and Steel Works Directory*.

36. "Manufacturing Notes," *American Manufacturer and Iron World*, 41, no. 20 (Nov. 18, 1887), 7; "Important Improvements at the Homestead Steel Works," *American Manufacturer and Iron World*, 41, no. 21 (Nov. 25, 1887), 10; Richards and Potter, "Homestead Steel Works," 435-436.

37. Drawing no. G-1816 (1906), Park Corporation collection, West Homestead, Pa.; "Favored Homestead," Homestead *Local News*, November 22, 1890, 1.

38. *Homestead Plant Description Book*, Park Corporation collection, 172-173, 177, 187-188.

39. Temin, *Economic Inquiry*, 225-226. Warren, *American Steel Industry*, 176, reports "in 1880 when [structural] production was 87,000 tons, most of it was still iron. National structural output increased threefold in the eighties, and by 1890 over half of it was steel."

40. Warren, *American Steel Industry*, 177.

41. Ibid., 176.

42. Ibid., 177; Gerald R. Larson and Roula Moudoudellis Geraniotis. "Toward a Better Understanding of the Evolution of the Iron Skeleton Frame in Chicago," *Journal of the Society of Architectural Historians* 46, no. 1 (March 1987), 39-48; Homestead *Local News*, November 22, 1890, 1.

43. "Manufacturing Notes," *American Manufacturer and Iron World*, 38 (April 23, 1886), 7; *The Iron and Steel Institute in America in 1890: Special Volume of Proceedings* (London: E. & F. Spon, 1892), 306; Marc Harris, "Bernard Lauth," *Iron and Steel in the Nineteenth Century*, Paul F. Paskoff ed. (New York: Facts on File, 1989), 239; Drawing no. G-1816 (1906), Park Corporation collection. Eugene L. DiOrio reports in *Lukens: Remarkable Past —Promising Future* (Coatesville, PA: Lukens Steel, 1985, np.) that Huston and Penrose, operators of the Lukens rolling mill, installed a 120" plate mill in 1890. In "The Manipulation of Iron and Steel Plates" *Iron Age* 48 (October 22, 1891), 680-682, Gram Curtis proposed the now-standard use of cooling beds—as opposed to the roller tables used at the 119" mill—to make more efficient use of space and includes a plan of the 119" mill as a contrast. Curtis' proposal was part of an industry-wide effort to reduce costs by improving the movement of materials through the production process. For an important discussion of this issue, including several examples from the Homestead Works, see Michael Nuwer, "From Batch to Flow: Production Technology and Work-Force Skills in the Steel Industry, 1880-1920," *Technology and Culture* 29, no. 4 (Oct. 1988), 808-838. While his thesis is valid, some of the details about Homestead need correcting. For example, Nuwer sees the entirely new construction of Open Hearth No. 3 as a remodeling of Open Hearth No. 1. However, a complete discussion of Nuwer's work is beyond the scope of this paper.

44. Wall, *Carnegie*, 646, quoting from Carnegie to Whitney (27 Dec. 1886), Henry Whitney Collection of W.C. Whitney Papers, Vol. 39, Library of Congress.

45. When Carnegie was later to have a change of heart about producing ordnance, his partners argued that naval artillery was unprofitable. Homestead never made guns. Wall, *Carnegie*, 645-646.

46. "The Largest Rolling Mill on Earth," *Iron Trade Review and Western Machinist* 20, no. 14 (April 2, 1887), 223.

47. "Carnegie, Phipps & Co., Limited, Will Make Armor Plate," *American Manufacturer and Iron World*, 39, no. 26 (Dec. 31, 1886), 9; "The Homestead Steel Works," *Iron Age* 42 (Nov. 1, 1888), 656-58; Richards and Potter, "Homestead Steel Works," 437-438.

48. "The Homestead 32-Inch Universal Mill," *Iron Age* 42 (November 15, 1888), 733-35; J.M. Camp and C.B. Francis, *The Making, Shaping and Treating of Steel* (Pittsburgh, Pa.: Carnegie Steel

Company, 1920), 385-387; "Homestead Armor Plate Mill," *Iron Trade Review* 24, no. 26 (June 25, 1891), 5.

49. "The Homestead Steel Works," *Iron Age* 42 (Nov. 1, 1888), 656-58; "A Three-Thousand Ton Shear," *Iron Age* 42 (Oct. 18, 1888), 575-576.
50. Armor Heat Record Book, Carnegie Steel Co., Cruiser *Olympia* Association Archives.
51. "Slabbing Mill, 63 Years Old, To Roll for Carnegie-Illinois," *Iron Age* 166 (July 27, 1950), 79.
52. Warren, *American Steel Industry*, 150.
53. "Removal of the Bethlehem Plate Mill," *Iron Age* 63 (Jan. 12, 1899), 18.
54. "Mammoth Plate Mill to be Built at Homestead," *Iron Trade Review* 30 (Dec. 23, 1897), 10; "Manufacturing Notes," *American Manufacturer and Iron World* 44, no. 20 (May 17, 1889), 7; "The Homestead 48-inch Universal Plate Mill," *Iron Age* 66 (Dec. 27, 1900), 1-2, 3, 4, 5.
55. The following paragraphs on armor plate are generally based on: Dean Allard, *The Influence of the United States Navy upon the American Steel Industry, 1880-1900* (M.A. thesis, Georgetown University, 1959); Benjamin Franklin Cooling, *Gray Steel and Blue Water Navy: The Formative Years of the Military-Industrial Complex, 1881-1917* (Hamden, Conn.: Archon Books, 1979); Misa, "Science, Technology"; Nathan F. Okun, "Face Hardened Armor," *Warship International*, no. 3 (1989), 262-289. For the steelmen's point of view see: American Iron and Steel Association, *History of the Manufacture of Armor Plate for the Navy* (New York: American Iron and Steel Association, 1899).
56. Cooling, *Gray Steel and Blue Water Navy*, 88.
57. Ibid., 216.
58. Gaddis Smith, "The First Freeze," *New York Times Magazine*, April 24, 1983, 110-111, 114.
59. Cooling, *Gray Steel and Blue Water Navy*, 166.
60. Robert Hessen, *Steel Titan: The Life of Charles M. Schwab* (New York: Oxford University Press, 1975), 52; Larry Schweikart, "William Latham Abbott", *Iron and Steel in the Nineteenth Century*, edited by Paul F. Paskoff (New York: Facts on File, 1989), 6. Schweikart claims that Abbot bid on armor for the *Maine* in 1888.
61. Krause, "Road to Homestead," 15-17. The phrase "practical metallurgy" is Krause's.
62. Okun, "Face Hardened Armor," 262, 277.
63. "Nickel-Steel Manufacture," *Engineering and Mining Journal* 50, no. 24 (Dec. 13, 1890), 688; Cooling, *Gray Steel and Blue Water Navy*, 98.
64. See Harry B. Latton's description of the Homestead Plant in *The Pittsburg Times*, June 1, 1892, to be reprinted in *The River Ran Red* (Pittsburgh, Pa.: University of Pittsburgh Press, summer 1992), David P. Demarest, Jr., and Russell W. Gibbons, editors, Fannia Weingartner, coordinator; John Fielding, metallurgist, BethForge, Bethlehem Steel, interviewed February 23, 1990.
65. Drawing no. AA-141 (July 28, 1891), Park Corporation collection.
66. Allard, *Influence of the Navy*, 103.
67. Armor Heat Record Book, Carnegie Steel Co., Cruiser *Olympia* Association Archives.
68. Harbord and Hall (vol. I: 286) report that plates under 12" thick were often rolled direct from the ingot.
69. "Great casting," *Iron Age* 53, March 29, 1894.
70. Conrad Milster, Stationary Engine Society, interviewed Feb. 22, 1990.
71. *The Superintendent's Club, Homestead District Works, United States Steel Company* (c. 1951), n.p.; Okun, "Face Hardened Armor," 266.
72. Report of visit to Homestead Works by H.D. Momz and E. O'C. Acker to R.W. Davenport, April 10, 1901, Archibald Johnston Papers, Hagley Museum and Library, Accession 1770 II-G-2(b) ff 2; quote: Okun, "Face Hardened Armor," 273.
73. See Cooling, *Gray Steel and Blue Water Navy*, 120-145; Hessen, *Charles M. Schwab*, 91-102; Allard, *Influence of the Navy*, 114-127; Wall, *Carnegie*, 652-653.
74. Misa, "Science, Technology," 130.
75. Wall, *Carnegie*, 649.
76. "The Week in Iron Circles: Pittsburgh," *Iron Trade Review* 31, no.9 (March 3, 1898), 3; "Carnegie Steel Buys Carrie Furnaces," *Iron Trade Review* 31, no. 9 (March 3, 1898), 10.
77. See also Drawing no. AH-200 (1894), Park Corporation collection.
78. *Iron Trade Review* 33, 15.
79. Wall, *Carnegie*, 654-657.

80. "Car Axle Manufacture at Homestead," *Iron Age* 63 (April 27, 1899), 18; "Rapid Erection of Howard Axle Works," *Iron Trade Review* 33, no. 6 (February 8, 1900), 14-15; "The Howard Axle Works of the Carnegie Steel Company," *Iron Age* 67 (June 13, 1901), 10-13. For a description of the process see *Making* (1920), 508-515.

81. Krause, "Road to Homestead," 31-33, 40-41.

82. See "The Kennedy Beam-End Shear," *Iron Age* 44 (Oct. 24, 1889), 633-35; "The Kennedy and Aiken Hydraulic Crane," *Iron Age* 44 (Nov. 14, 1889), 754-756; "Aikens Hydraulic Metal Tie Machine," *Engineering and Mining Journal* 48, no. 18 (Nov. 18, 1889), 384-85; "The Aiken Hydraulic Crane," *American Manufacturer and Iron World* 44, no. 15 (April 12, 1889), 3. Kennedy and Aiken also developed a universal beam mill in the 1880s: R.E. Beynon, "Beam and Channel Roll Design," *Association of Iron and Steel Engineers Yearly Proceedings, 1949*: 320-321. Kennedy is variously reported as having been general superintendent from 1885 to 1888 or 1889 (*Superintendents' Club*, n.p.) and Larry Schweikart's biography of Julian Kennedy in Facts on File #60, 222-225.

83. "How Electric Traveling Crane Came," *Iron Age* 118 (Aug. 26, 1926), 542. See also H. Harnischfeger, "First Electric Traveling Crane Built in the United States" (letter to tho editor), *Iron Age* 118 (Sep. 9, 1926), 722. In a note appended to Harnischfeger's letter the editor of *Iron Age* reports that electric cranes were "interwoven with the history of the disastrous and bloody strike . . . in the summer of 1892," but the relationship is not clear.

84. "General Industrial Notes," *Iron Trade Review* 27, no. 4 (Jan. 25, 1894), 14; "Manufacturing: Iron and Steel," *Iron Age* 53 (Feb. 22, 1894): 372, Hogan, *Economic History*, 432, reports that "in 1892 direct current motors were installed to operate cranes at [Carnegie Steel's] Homestead Works and in 1893, Homestead Works installed motors to drive table rolls."

85. *Views in Homestead Steel Works.*

86. Temin, *Economic Inquiry*, 138-139.

87. "The Wellman Charging Machine," *Iron Age* 58 (Aug. 27, 1896), 397-98; "Handling Materials at Homestead," *Iron Age* 60 (Aug. 12, 1897), 8-9; "The New Open Hearth Plant of the Carnegie Steel Company, Limited," *Iron Age* 61 (June 30, 1898), 12-14.

88. This section on labor, technology, and community is based on Krause, "Road to Homestead"; Fitch, *The Steel Workers*; Arthur G. Burgoyne. *The Homestead Strike of 1892* (Pittsburgh: Rawsthorne Engraving and Printing Co., 1893; repr., Pittsburgh: University of Pittsburgh, 1979), original title *Homestead*; David Montgomery, *The Fall of the House of Labor. The Workplace, the State, and American Labor Activism, 1865-1925* (New York: Cambridge University Press, 1987); Wall, *Carnegie*, chapter 16. Additional important bibliography includes: J. Bernard Hogg, "The Homestead Strike of 1892" (Ph.D. diss., University of Chicago, 1943); David Brody, *Steelworkers in America: The Nonunion Era*, (Cambridge: Harvard University Press, 1960; repr., New York; Harper and Row, 1969); Curtis Miner, *Homestead: The Story of a Steel Town* (Pittsburgh: Historical Society of Western Pennsylvania, 1989).

89. Krause, "Road to Homestead," 10.

90. Montgomery, *Fall of the House of Labor*, 36.

91. Krause, "Road to Homestead." The summaries of the 1882 and 1889 strikes are based on chapters 5 and 6. The University of Pittsburgh Press is publishing a revised and expanded version of this work in 1992.

92. Krause, "Road to Homestead," 543.

93. Wall, *Carnegie*, 539.

94. Montgomery, *Fall of the House of Labor*, 41.

95. The modernization of the original 28" blooming mill would be an exception to this. See also Fitch, *The Steel Workers*, 140.

96. U.S. Census, 1890 and 1900; Miner, *Homestead*, 18, 53. The census figures are for total native-born white, foreign-born white, and nonwhite residents. Increases for each category are, respectively: 3,529 (65%); 1,114 (45%); and 517 (386%).

97. The narrative that follows is based on a 1990 draft National Historic Landmark Nomination prepared by the author and Ron Kaplan, an intern with the Historic American Engineering Record.

98. *Pittsburgh Post*, July 7, 1892, 1; *Pittsburgh Times*, July 7, 1892, 1.

99. Philip S. Foner, *History of the Labor Movement in the United States* (New York: International Publishers, 1955), vol. 2, *From the Founding of the American Federation of Labor to the Emergence of American Imperialism*, 218.

100. Brody, *Steelworkers in America*, 78.

101. Personal communication, Charles McCollester, Pennsylvania Center for Study of Labor Relations, Indiana University of Pennsylvania, Summer, 1990.

102. Fitch, *The Steel Workers*, chapters 16, 17, 18.

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APPENDIX I - HOMESTEAD WORKS SITE INVENTORY

CONTENTS - HOMESTEAD WORKS SITE INVENTORY

Introduction

An integrated steel mill of the size and age of the Homestead Works has a complex technological, labor, and community history with each operating on local, regional, national, and often international levels. The history of the Homestead Works can be divided into five periods: establishment, the Carnegie era, the United States Steel era, the World War II era, and the post-war era. This summary will describe the most important highlights of the Homestead history. Following this is a discussion of the importance of the 1892 Landing Site, including the Water Tower, Pump House and Roll Shop, Carrie Furnaces No. 6 and No. 7, the Press Shop, the 48" Plate Mill, and the "Big" Machine Shop.

At Homestead, a steep cliff on the right bank forces the Monongahela River to take a broad ninety degree left turn as it descends from Duquesne and Braddock. The left bank rises more gradually than the right and the Homestead Works stands on the narrow two-and-one-half mile long flood-plain. The Carrie Furnaces are shoe-horned into the space on the right bank just upstream from the cliff that turns the river. The Pittsburgh, Virginia & Charleston and the Pittsburgh, McKeesport, & Youghiogheny Railroads, branches of the Pennsylvania and the Pittsburgh & Lake Erie respectively, pass through the site. The former marks the edge of the flood plain and the later parallels the former until it turns aside to cross over the river just below the Carrie Furnaces. Before the construction of roads, the river and its high banks limited access to Homestead from the rest of the region. During the strikes of the 1880s and 1890s, this geographical isolation allowed the workers to seal off the community, but the geography ultimately limited the expansion and life of the mill.

Each time the mill was expanded or modernized, the new facilities were laid out to fit the constraints of the geography and the existing facilities. Consequently, the campaigns are revealed in a series of grids or building orientations. The original core of the plant consisted of the Pittsburgh Bessemer Steel Company's converting and blooming mills parallel to Andrew Klowman's rail mill. The first break to this pattern came in 1886 with the construction of Open Hearth No.1. Most of buildings upstream from Open Hearth No.1 are parallel or perpendicular to its axis. Likewise, expansion of the production of structurals (the retooled Rail Mill) took place downstream of the Bessemer complex following the orientation of the Bessemer. By the time the Armor Plate Department was installed in the early 1890s, a combination of the existing site congestion and the size of the new structures required expansion downstream of the P&LE tracks. The Armor Plate Division was planned with its long axes perpendicular to the Bessemer mill in order to accommodate the processes to the triangular plot between the river, the railroad, and City Farm Lane. Beginning in 1893, the Carnegie Steel Company built the Union Rail Road to connect all of its Monongahela plants. At Homestead, the right of way followed the river bank.

Most of the expansion during the twentieth century took place below City Farm Lane. About 1900 the company purchased land in the residential and commercial district adjacent to its riverfront rail line and immediately downstream from City Farm Lane. Intended for several plate mills recently purchased from the Bethlehem Iron Company (later Bethlehem Steel), the buildings had to conform the existing property lines — lines which did not conform to any in the older section of the works.

NINETEENTH CENTURY

<u>Establishment</u>

In 1879 several steel fabricators formed the Pittsburgh Bessemer Steel Company to make merchant steel for their mills. The Pittsburgh Bessemer Steel Company was part of a national trend away from wrought iron manufacture and towards mechanized production of steel. This shift was spurred not only by a desire by owners to increase day to day control of the work place, but also to increase productivity.

One of the founders, Andrew Kloman, a former partner of Andrew Carnegie, built a rail and structural mill adjacent to the works. Kloman died before his mill was completed. The Pittsburgh Bessemer Steel Company bought Kloman's mill and began to sell rail in competition with the established producers including Carnegie's Edgar Thomson Works.

<u>Technology</u>

Pittsburgh Bessemer may be the first Bessemer plant in the country constructed for non-rail production. The plant and its equipment was designed to avoid certain patents held by the Bessemer steel cartel. It marks the beginning of the era of the wide availability of cheap steel for a great number of uses. Several highly talented engineers, including internationally renowned Alexander Holley, contributed to its design.

<u>Andrew Carnegie</u>

In 1883, in the midst of a financial depression and a continuation of the 1882 labor difficulties, Carnegie acquired the works at or near cost. He transformed Homestead from a

Bessemer rail mill to a highly mechanized, fully integrated heavy products mill. Carnegie sought to maximize profits on high volume production. To this end he developed accounting procedures that allowed him to compare and monitor management's performance, developed new steel products and processes, extended control over all phases of production from mine to finished product, and reduced labor costs via increased mechanization and non-union shops.

Carnegie and his partners rebuilt the Homestead works. They installed several important new facilities: three basic open hearth furnace buildings, four blooming mills, three structural mills, two slabbing mills, four rolled plate mills, a wheel and axle works and an entire armor plate forge. Furthermore, they acquired and expanded the Carrie furnaces across the Monongahela from Homestead. Open Hearth No.1 was the first facility for large scale commercial production of basic open hearth steel in the country. The development of the open hearth was essential for high quality structural and armor steels. When installed, the 32" universal slabbing mill, the 48" universal plate mill, and 119" plate mill were each described in the trade literature as the largest of their types in the country. Homestead rivaled all other mills in structural steel production during the same era that saw the emergence of the skyscraper and the steel truss bridge. The armor forging plant at Homestead played a central role in the development of American sea power and the American military-industrial complex. Homestead was a leader in the use of machinery such as hydraulic and electric cranes to reduce labor and increase production tonnage.

<u>Community and Labor</u>

While mechanization decreased the number of employees per facility, the overall expansion of the mill required vast amounts of unskilled labor — after 1892, provided largely by Eastern European immigrants. In contrast to the waning fortunes and declining numbers of skilled workers, the machine-tending responsibilities of the new, unskilled laborers was a first step towards their realization of the American dream.

Unlike other mill towns in the region, the Borough's municipal government was composed of Homestead workers. Consequently, civic authority supported labor in disputes between management and workers. These community ties were critical factors in the resolution of the 1882 and 1889 lockouts in favor of labor. In the famous lockout of 1892, however, the Amalgamated Union of Iron and Steel Workers was defeated by Carnegie and the State of Pennsylvania. This not only eliminated the union in Homestead but also inaugurated a period of nonunion labor in the American steel industry that lasted until the 1930s.

TWENTIETH CENTURY

United States Steel

The turn of the century witnessed a consolidation of American industry into large corporate "trusts". Under the financier J.P. Morgan and Judge Elbert Gary, finished steel producers consolidated their operations, and in 1901 Morgan pre-empted competition from Carnegie's expansion into finished steel by purchasing Carnegie Steel. The result was the United States Steel Corporation, the first billion dollar corporation and the culmination of the consolidation movement. U.S. Steel moved quickly to acquire new properties, complete and begin new production projects, and dispose of marginal operations, in an effort to further reduce competition.

Shortly after the merger, expansion at Homestead included a doubling of the Armor Plate Division's capacity (to supply newly elected Theodore Roosevelt's "Great White Fleet"), installation of a fourth open hearth facility, and construction of Carrie Furnaces No.6 and No.7 to provide additional iron capacity for the new open hearth. Homestead also entered the steel railroad wheel trade with the acquisition of the Schoen Steel Wheel company and the introduction of the Slick Wheel process.

Under Judge Gary, U.S. Steel operated according to a conservative investment policy known as "cooperative competition." This policy, together with the shifting of steel markets to the east and midwest, meant a gradual waning of the Mon Valley's importance to U.S. Steel as a site for new capacity. The construction of fully electrified open hearth works at Gary, Indiana and the acquisition of Tennessee Coal and Iron represented corporate decisions to expand in other regions. As a result, Homestead never again underwent a peacetime expansion and modernization comparable to that experienced under Carnegie.

Despite these broader trends, Homestead continued to prosper well into the twentieth century. During World War I U.S. Steel built its first electric drive plate mill, the 110" "Liberty" Mill. Wartime production changed the shape of community life, as labor shortages drew the migration of southern blacks to northern industrial centers. And while the 1919 Strike reaffirmed the weakness of organized labor and led to a decline in U.S. Steel-sponsored community programs, the eight hour day was instituted.

During the 1920s U.S. Steel modernized Homestead's structural mills in an effort to recapture sales lost to Bethlehem Steel after the nation's second largest steelmaker introduced the wide flange beam in 1908. Completed in 1925, the fully electrified facility included the nation's first 54" blooming mill, the largest ever built. Despite the Depression, U.S. Steel constructed a 100" semi-continuous plate mill using four-high strip mill technology developed in the 1920s. This design yielded improved gauge (thickness) control and high volumes, and replaced the "Liberty" Mill as well as several other plate mills installed about 1900.

World War II Period

World War II brought the most significant changes to the mill and community since 1892. The federal government's Defense Plant Corporation built a fifth open hearth, a second armor forge plant, a universal slabbing mill, and a wide plate mill. Homestead's long-time relationship with the Navy, and the limited number of companies with comparable resources, were key factors that determined the government's choice of location. The $89 million project increased the overall size of the mill by about a third and required the evacuation of 8,000 people, forever altering the social fabric of Homestead. U.S. Steel acquired the facilities after the war for roughly $63 million, in addition to about $23 million in rent.

Postwar technical developments at the Homestead Works included the commercial development of high-strength alloy steel plate; after the Korean War, the forge division tooled up to produce nuclear containment vessels and electric generator shafts. Homestead's community entered a period of dramatic change and growth as New Deal reforms, the formation of the Steelworkers Organizing Committee and United Steel Workers, and a post-war boom in steel production supported the emergence of a new middle-class from the Valley's blue-collar workers.

LIST OF SIGNIFICANT RESOURCES

Original Armor Plate Division: 1891-1903

The Forging Division at Homestead includes two early 1900s buildings, as well as steel-making equipment, that are nationally significant. One of the buildings, **Press Shop No.1**, contains the 12,000-Ton Forging Press and steam engine, and is the nation's only surviving example of a turn-of-century heavy-steel forging plant. The armor plate made here contributed to the nation's rise as a world power.

West of Press Shop No.1 stands **Machine Shop No.2**, a tall one-story brick and steel-frame building, erected ca. 1903. Armor plate was machined here prior to shipping. The building contains numerous lathes, shapers, planers, and boring mills, most of which date from the 1940s-1960s.

The **Armor Plate Division Office Building** is now part of the Big Shop and was built in 1899. It is a two-bay two-story brick building with a gable roof and is the only part of the original Armor Plate Machine Shop that survives.

The **Harvey Shop**, constructed in 1893, was used to heat-treat the armor plate. Expanded several times, most recently in 1939, the Harvey Shop when abandoned in 1985 measured 1000' x 130'. Unfortunately, the Park Corporation demolished most of the building in August 1989. Only a section of the 1939 addition survives.

1892 Pinkerton Landing Site, including the Pumphouse No.1 and the Water Tower

The attempted landing of Pinkertons immediately upstream from the **Pumphouse No.1** on July 6, 1892 is of national significance in the history of American labor and industry. The ensuing battle left at least ten dead and many injured, turned the tide of public opinion against the striking Homestead workers, led to the imposition of martial law, and ensured non-union shops throughout the steel industry until the late 1930s.

The landing site itself has been obscured (but conceivably preserved by) by a concrete retaining wall. The only surviving structure near the site is the **Pumphouse No.1**, which was expanded in the early 1900s. The lightly ornamented brick walls of this early Pumphouse remain in place.

The **Water Tower** now standing adjacent to Pumphouse No.1 was built in 1893 and replaced the original water tower that stood at the time of the Homestead Strike of the previous year. Although the present Water Tower is of iron construction, instead of the original wood-stave and iron-hoop structure, it functioned in the same way as the original water tower. It is also one of the oldest surviving structures at the Homestead Works.

Carnegie Steel Company Buildings: 1883-1900

The years 1883 to 1900 were crucial ones for Homestead for this is when Andrew Carnegie and his partners purchased the mill and converted it into one of the world's premier armor plate producers. Unfortunately, few buildings and no equipment survive from the Homestead Works. (None of the extant buildings or structures at Carrie Furnaces were built until the early 1900s, after U.S. Steel had formed and was operating the Homestead Works). The few Carnegie-era buildings that survive include:

The **32" four-high Universal Slabbing Mill Buildin**g was erected in 1888 and is the earliest surviving building at the Homestead works. In 1904 the interior space of the 32" Universal Slabbing Mill Building was incorporated into the construction of the 140" Mill Building. The 32" Slabbing Mill continued operating until 1952 when U.S. Steel shut it down. Shortly thereafter U.S. Steel removed the 32" Universal Slabbing Mill and installed a series of soaking pits in its place. Despite these changes U.S. Steel retained much of the building's historic fabric including its metal frame and pin-connected Fink roof trusses (the only of its kind to survive at Homestead). **Unfortunately, the Park Corporation began demolition of the mill building in 1990.**

The **48" Universal Plate Mill Building and Mill** were constructed in 1899. The steam-powered mill, manufactured by Mackintosh-Hemphill of Pittsburgh, operated from 1899 until 1979, when it was retired. Remarkably preserved, the 48" universal plate mill and reversing steam engine is the only surviving plate mill of this type in the country. The Park Corporation has demolished much of the mill building, including the sections containing the pre-heating furnaces and the runout table for the plate mill.

The **Roll Shop**, located approximately 300 feet from the landing site, was built ca. 1895. It contains pin-connected Fink trusses, a rare remnant of a typical nineteenth century building technology. **The Roll Shop was torn down in June 1990.**

The **30" Mill Building**, erected ca. 1898, is a tall steel-frame building with corrugated metal siding. It measures 1000' x

200' and originally housed a group of plate mills purchased from the Bethlehem Iron Company. The plate mills were removed in the 1940s and the 30" Mill Building was subsequently converted into a maintenance shop. **The 30" Mill Building was torn down in the fall of 1989.**

First World War Expansion: 1917-1919

For wartime at its Homestead Works, U.S. Steel relied largely on increased production using its existing facilities. The one major exception to this was the construction in 1917 of a new 110" Plate Mill, also known as the Liberty Mill. The two surviving remnants from the Liberty Mill include the **Liberty Mill Office Building**, a two-story brick structure that was converted in the 1930s into the 100" Plate Mill Office, and part of the **Liberty Mill Building.** The latter structure, of steel frame construction with metal siding, was incorporated into the 100" Plate Mill when it was constructed in 1936.

U.S. Steel Structural Mills and Big Shop: 1920s

In the 1920s U.S. Steel modernized the mills within the Homestead Works that produced structural beams, columns, and miscellaneous steel sections. This modernization marked a dramatic rise in competition between the Bethlehem Steel Company, which controlled a large part of the structural steel market, and U.S. Steel. A number of Homestead's existing structural mills were torn down and a huge new fully electrified structural mill facility was erected. This included the **40" and 54" Blooming Mills**, the **36" Mill**, the **28"/32" Mill**, and the **52" Universal Mill.** Unfortunately, most of the Structural Mill Buildings and the mills housed inside were recently scrapped. As of August 1989, only the two motor rooms that powered the mill, along with the 28"/32" Mill, survive. Most of Structural Mill Buildings have been demolished.

Originally built in 1899, the **Big Shop** was almost entirely rebuilt when U.S. Steel expanded it in 1926. (The only nineteenth-century remnant associated with the Big Shop is the Armor Plate Division Office Building--see above.) Initially used as a maintenance shop to serve the Homestead Works, more recently, the Big Shop was utilized as a general repair shop for all of the U.S. Steel Mon Valley Plants. As such, it played a central role in maintaining U.S. Steel's Mon Valley operations. Although the Park Corporation has sold some of the machinery from the Big Shop, it retains many of its lathes, boring mills, shapers, planers, and drill presses, most of which date from the 1950s-1970s.

In addition to the construction of the Structural Mill and Big Shop, the 1920s witnessed the expansion of electrical power within the Homestead Works and Carrie Furnaces. A new 15,000-kilowatt turbo-generator unit was added to the **Turbo-Generator Building**, located near Carrie Furnace No.3 and No.4. The fully electrified Structural Mill as well as the newly constructed Big Shop were served by the Turbo-Generator facility. **The Park Corporation demolished the Turbo Generator Building in the summer of 1989.**

U.S. Steel's Plate Mill Expansion: 1930s

Despite the depressed steel market during the early and mid 1930s, U.S. Steel constructed a modern 100" Plate Mill which superseded the Liberty Mill. The **100" Plate Mill Building** and the electrically powered **100" semi-continuous plate mill.** This new facility featured a four-high reversing roughing mill, the first of its kind in the nation. Plate produced here was used for tanks, barges, girders, and a range of other fabricated steel products. U.S. Steel ceased operating the 100" Plate Mill in 1985 when orders for plate from this high-volume mill declined. Importantly, the mill and much of its original machinery remain intact.

The Defense Plant Expansion: 1941-1945

The Defense Plant expansion was begun in 1941 and marked the most dramatic alteration to the Homestead Steel Works and the community since the mill was first constructed in the 1870s. Construction of the Defense Plant required the removal of some 1,200 buildings that were located in parts of Homestead's First and Second Wards. The 120-acre plant, which increased the size of the steel works by over one-third, displaced about 8,000 people. In place of homes, businesses, and churches, U.S. Steel and the Defense Plant Corporation constructed a huge open-hearth facility (**Open Hearth No. 5**), a second forging division (**No. 2 Forge**), a **45" Universal Slabbing Mill**, and a massive plate mill (the **160" Plate Mill**). In addition, two of the Carrie Furnaces, No. 3 and No. 4, were rebuilt, enlarging the capacity of each of these blast furnaces.

Upon its completion in 1943, **Open Hearth No. 5** dominated the main entrance to the Homestead Works. Measuring approximately 2000' x 300', and rising nearly 120' in height, the steel-frame building housed eleven 225-ton furnaces, two 800-ton mixers, as well as pouring ladles, ingot moulds, slag thimbles, and overhead cranes. Steel ingots from Open Hearth No. 5 were shipped to the forging division for production of armor plate, used in the war effort. After the war U.S. Steel purchased the Defense Plant and

Open Hearth No. 5 produced steel for all of the Homestead mills. In 1959 U.S. Steel constructed large modern gas-cleaning electrostatic precipitators, used in conjunction with the open-hearth shop. The giant open-hearth shop continued in operation until 1985 when U.S. Steel closed the Homestead Works. The large blue-and-white "USS" sign on the open-hearth shop building was considered something of a local landmark. Unfortunately, Open Hearth No. 5, was one of the first buildings demolished following the Park Corporation's acquisition of the site. Currently, parts of the steel-frame stand as does the electrostatic precipitator building. **Sadly, all of the open hearth furnaces and equipment were scrapped, as was the giant "USS" logo that was emblazoned on the open-hearth building.**

Constructed in 1942-43 by the Defense Plant Corporation, **Press Shop No.2** contains heating, forging, and treating bays housed in a steel-frame building measuring 800' x 350'. When placed in operation in 1943, Press Shop No.2 augmented the production from Press Shop No.1 (see above entry on Press Shop No.1). The new facility featured ten furnaces for heating the steel ingots produced at either Open Hearth No. 5 or the Electric Furnace Plant at Duquesne. The centerpiece of Press Shop No.2 was the 10,000-ton Mesta press, which operated using a water-hydraulic system with two compressed air accumulators. Closed in the early 1980s, Press Shop No.2 retains virtually all of its equipment.

Adjoining Press Shop No.2 is **Machine Shop No.3**, also constructed by the Defense Plant Corporation in 1942-43. Measuring 690' x 106', U.S. Steel used this shop for machining special forgings such as long shafts for naval vessels. It houses numerous lathes, drills, shapers, and milling machines dating from the 1940s through the 1960s. The building retains equipment and has not been substantially altered.

Among the largest plate mills in the United States, the **160" Plate Mill** was constructed by the Defense Plant Corporation in 1943-44. It is located next to the Monongahela River and consists of numerous bays of steel-frame construction, encompassing an area of about 1800' x 500'. Housed within several buildings were the motor room, the four-high plate mill, the shears, and storage and shipping facilities. Heat treating was originally carried out in the Specially Treated Steel Shop (see below); however, after the war heat-treating furnaces were added to the 160" Plate Mill. The complex remains intact and the Park Corporation has discussed bringing it back on line.

The Defense Plant Corporation constructed the **45" Universal Slabbing Mill** and, when it opened in 1944, it contained the first primary mill to use roller bearings on its horizontal rolls. Located between the 160" Plate Mill and the city of West Homestead, the multi-bay steel frame building featured a 45" Universal Slabbing Mill, manufactured by United Engineering of Pittsburgh. Connected to the mill was the motor room, which contained two 5,000 horsepower DC motors, ingot stripper, and soaking pits. Open Hearth No. 5 produced steel ingots for use in the 45" Slabbing Mill. When U.S. Steel closed the 45" Slabbing Mill in the early 1980s, it removed two of the large DC motors and parts of the Universal Slabbing Mill. The Park Corporation continued gutting the mill and today little equipment remains inside the buildings.

Measuring 1000' x 100', the **Specially Treated Steel (S.T.S.) Shop** was constructed in 1941 for the United States Navy under a contract separate from the Defense Plant. Specially treated steel is an ultra-service, high tensile strength steel developed during World War II to conserve scarce alloy additives. The building contained batch furnaces to heat treat the rolled plates, a process subsequently made obsolete by the Plate Treatment Line of the 160" Mill. The building was converted to the production of cold reduction rolls for strip mills in the late 1960s. It contains several core and mold ovens, along with lathes, boring mills, and quenching tanks, all of which serviced the rolls used in U. S. Steel's cold strip mills. Much of this 1960s equipment remains in place and the building is largely unaltered from the 1940s.

Carrie Furnaces

As recently as June 1989, four blast furnaces and related buildings stood at the Carrie Furnace site. This included Carrie No. 3, No. 4, No. 6, and No. 7, and the associated cast houses, blowing engine houses, and machine and blacksmith shops. Historically, this group of blast furnaces, along with those at Duquesne, the Edgar Thomson Works, and the National Works, were part of the largest iron-producing district controlled by one company--U.S. Steel--in the United States. Sadly, Carrie No. 3 and No. 4, along with one of the few (possibly the only) surviving turbo-blowing engine house and machinery dating from the 1920s, were demolished.

Carrie No.6 and No.7 Blast Furnaces and the blast-furnace plant, including the **Ore Yard** and **Stockhouse**, **AC Power House**, **Blowing Engine House**, **Cast Houses**, were constructed in the 1906-09 and were periodically renovated and modernized until they were shut down in the early 1980s. These and the auxiliary structures are nationally significant historical resources as part of a larger group of blast furnace plants in the Monongahela Valley.

This includes blast furnaces at Duquesne and the Edgar Thomson, all of which are representative of iron-making technology that was first developed in the Monongahela Valley. This technology includes the earliest use of automatic raw material handling, storage, and delivery systems, first installed at Duquesne in 1896, and incorporated into the design of all subsequent blast furnaces in the Valley and the nation. From 1880 to 1980, the blast furnaces of the Monongahela Valley supplied the iron essential to the operation of one the preeminent steel making complexes in the entire world.

Conclusion

Embracing the buildings, structures, and equipment listed above, the Homestead Steel Works and Carrie Furnaces are historically significant on local, regional and national levels because it participated in or contributed to numerous major local, regional, and national trends in American history. These trends include:

- iron and steel technology
- national defense
- labor history
- corporate history
- social history

As a group these historic buildings, structures, and steel-making equipment embody these themes and contribute to the interpretation and understanding of one of the nation's most important steel mills. However, recent and ongoing demolition have seriously compromised the integrity of many of the historic resources listed above. As a result of this demolition, a new strategy must be developed that seeks to preserve individual buildings and pieces of machinery, and links them to the broader patterns of technological, business, social, and labor history, within the Mon Valley. For it was the Valley that was the pre-eminent iron and steel center in the United States for much of the nineteenth and twentieth centuries.

IRONMAKING - CARRIE BLAST FURNACE PLANT

Iron making at the Carrie Furnace site began with the moving of a blast furnace from Ohio in 1883. Blown-in during February of 1884, the 70' furnace had a 18' bosh and an estimated annual capacity of 40,000 net tons. The furnace was operated by James S. Brown, President; E.L. Clark, Secretary; H.C. Fownes, Treasurer; and W.C Fownes, Manager. Presumably, one of the owners had a wife, sister, or daughter named Carrie. Carrie No. 2 was added in 1889. The complex was one of the few remaining independent furnace companies in the Pittsburgh area when Carnegie bought it in 1898. It seems reasonable to assume that the purchase was made with the ultimate goal of a rail link between Carrie and Homestead.

Whatever the case may be, the Hot Metal Bridge was constructed in 1900 and reduced, if not eliminated, Homestead's dependence on the other Carnegie furnaces in the Monongahela Valley for hot metal. Carrie No. 3 and No. 4, begun in 1899, were blown-in in 1901. Construction for No. 5 began the next year and was completed in 1903. The last furnaces, Carrie No. 6 and No. 7 were completed in 1907. Large scale electric power generation at Carrie began at this time with the construction of the AC Power House. Additional generating capacity was added during World War I and in the mid-1920s. Carrie No. 5, dormant during the Depression, was dismantled in 1938, and its site was reused for a new power plant built during World War II. The 1950s saw the completion of a sinter plant, and a major reconstruction of No. 3 and No. 4 to 28' hearths. No. 2 was taken off line in the mid-1960s, and No. 1 followed in the next ten years. No. 6 and No. 7 were taken off line in 1978. Iron making ceased at Carrie altogether when No. 3 and No. 4 were taken off line in 1984.

Sources:
Works Directory, American Iron and Steel Institute, 1884, pp. 25-26; (1890), p. 25-26; (1908), p. 6; (1939), p. 79; (1960), p. 316; (1967), p. 287; (1977), p. 300. Hereafter cited as Directory.

Kulik, Gary B. "Sloss-Sheffield Steel and Iron Company Furnaces." Washington, D.C.: Historic American Engineering Record, 1976.

Historic Name: United States Steel, Homestead Works, Carrie No. 3 and No. 4 Ore Bridge, Ore Yard, and Stockhouse.
Present Name: Park Corporation, Carrie Furnaces, Carrie No. 3

and No. 4 Ore Bridge, Ore Yard, and Stockhouse.
Location: Rankin, Allegheny County, PA
Construction: 1901, 1955
Documentation: Photographs of the Carrie Blast Furnace Plant can be found in HAER No. PA-200-A.

DESCRIPTION

The ore bridge for Carrie No. 3 and No. 4 serves the approximately 550' x 375' ore yard and is about 120' high. Built by Dravo Engineering and American Bridge, the bridge is a Warren truss with a 15-ton bucket hoisted by two 125-hp winches and moved along the length of the bridge by two 250-hp motors. Ore was brought from the car dumper to the ore yard by transfer cars on rail lines sunk below the riverside wall of the ore yard. A bucket on the ore bridge fills a hopper suspended from the bridge above the stockhouse which empties into a bin car that keeps the stockhouse ore bins full. The stockhouse is a concrete structure approximately 35' high and 500' x 50'. On top of the stock house are three rail-tracks and one of the two bin-cars that kept the ore and flux bins full. The third set of rails was used for the delivery of coke from the by-product ovens at the Clairton Works. Inside the stock house are coke screens, coke-breeze skip-hoists, scales, and ore bins needed to supply the two blast-furnace skip-hoists. A ventilation system removes air-born coke dust from the coke screen areas to the ore yard.

HISTORY

The current ore bridge was built in 1955. First installed at the Duquesne Works, ore yards were developed in conjunction with the introduction of iron ores from the Great Lakes region. Ore yards were used to stock pile ore for the winter weather which stopped navigation on the Great Lakes and interrupted deliveries from lake-side docks. Originally, Carrie No. 3 and No. 4 had two ore bridges and their own car dumper. Built by the Brown Hoisting Machinery Co., Cleveland, Ohio, the bridges ran perpendicular to the furnace stoves and spanned 558' over the ore yards. Two stockhouses, one for each furnace, extended from the skip hoist pit towards the river. The ore bridges traveled between the stockhouses, and loaded ore and flux into bins in the stockhouses. Motorized buckets suspended from the bottom of the bins took the materials to the skip hoist bucket. These may have be removed when No. 3 was rebuilt during World War II.

Sources:

U.S. Steel Drawing FM-200, 1945. Unless otherwise noted, all drawings are in the possession of the Park Corporation, Print Room, West Homestead, PA.

Cowles, W. L. "Handling Ore at a Blast Furnace." Cassier's Magazine 22(June 1902): 157-74.

Stapleton, J. M. and D.H. Regelin. "The New Giant in the Valley." Blast Furnace and Steel Plant 47(January 1959): 55-61.

Historic Name:	U. S. Steel, Homestead Works, Carrie Furnaces No. 3 and No. 4.
Present Name:	Park Corporation, Carrie Furnaces: Carrie No. 3 and No. 4.
Location:	Rankin, Allegheny County, PA.
Construction:	1901, 1957
Documentation:	Photographs of the Carrie Blast Furnace Plant can be found in HAER No. PA-200-A.

DESCRIPTION

Carrie No. 3 and No. 4 consist of two furnaces and cast houses, seven hot blast stoves, gas-cleaning equipment, and a pump house arranged symmetrically about an axis between the two cast houses. The furnaces are about 210' high with double-bell McKee tops, three bleeder valves, a 105' stack, 29-1/2' hearth, 20 tuyeres, one iron and two slag notches, and steam-atomized fuel oil injection. Both cast houses are approximately 100' x 50' and 96' high. The steel-frame buildings are open at the base. The roof system is composed of riveted-steel Fink trusses under separate riveted Warren trusses covered with steel plates. Some of the roof plates are over-lapped in such as way as to keep out the weather while providing ventilation.

Five rail-lines run directly under the elevated cast house floors and are used to take away the iron and slag. Cast house No. 3 retains its mud gun, and both cast houses have mud-gun control-rooms and refuse bins. The flooring immediately around the furnaces is brick. Each furnace has three lateral combustion-chamber hot-blast stoves. An extra stove, located between the others, was installed as a "swing," or back-up stove, but was unsuccessful. Gases from the top of the furnaces are sent to the gas cleaning equipment and then burned in the hot blast stoves.

At the time of the survey, both furnaces still retained their dust catchers, but only No. 4 had its Venturi washer and gas-cooling tower. A one-story concrete-block pump-house provided water for furnace cooling and gas washing. Three pumps, each with a capacity of 5,000 gallons per minute, remain in place.

HISTORY

Construction on Carrie No. 3 and No. 4 began in November 1899 and the furnaces were blown-in during February and April of 1901, about the same time that Carnegie was selling his interests to United States Steel. The movement of iron from Carrie No. 1 and No. 2 to Homestead had begun the previous year via a newly constructed hot metal bridge. Reported by Iron Age to be the largest in the world, the furnace stacks were 105' in height and had 23' diameter boshes, with a production capacity of 700 tons per day. Later in 1901, No. 3 produced a world record 790 tons of iron in one day. The original steam blowing engines were located in the old part of the adjacent Turbo-generator building, and the boiler house was located between the two cast houses. Each furnace had four Massicks and Crooke three-pass hot-blast stoves. Both furnaces were rebuilt in 1927 and the height of the stacks was reduced to 94'-11". To increase yield from the fine textured Mesabi ores, the hearth and bosh of each furnace were changed to 24'-6" and 24'-9" respectively. In 1927, the Warren trusses were constructed over the existing monitor-roof Fink trusses of the cast houses. By the mid-1940s, the boiler house located between the cast houses was demolished and the space was used for a gas washing tower, an electrostatic precipitators and a thickener. In 1957 Carrie No. 3 was rebuilt with a 28' hearth --the first 28' hearth installed by U.S. Steel in the Monongahela Valley. Lateral chamber stoves replaced the three-pass stoves. The new stoves required cleaner gas to operate and the gas washer was converted to a gas cooler and a Venturi washer was added. The increased capacity required the utilization of new 150-ton "torpedo" ladles manufactured by Pollock Co., Youngstown, Ohio. The capacity of the hot metal bridge limited the size of these new ladles. Carrie No. 4 was rebuilt along the same lines in 1959.

Sources:
Directory (1908), 6; (1926), 83; (1930), 83; (1935), 84; (1977), 300.

Lose, James E. "The Operation of Large Hearth Furnaces Using Coke Made from One Hundred Per Cent High Volatile Coal." American Iron and Steel Institute Yearbook (1927): 79-102.

"McClure & Amsler's Hot-Blast Stove." Iron Age 49(May 5, 1892): 864.

Regelin, D. H. and J.M. Stapleton. "The New Giant in the Valley." Blast Furnace and Steel Plant 47(January 1959): 55-61.

Sanborn Map Company. Homestead, Pennsylvania. New York: Sanborn

Map Company, 1901, and 1908. Hereafter cited as Sanborn.

Slater, Bill. Superintendent, Carrie Furnaces, 1969-1978. Interviewed by author, August 30, 1989, and October 18, 1990.

"The New Carrie Furnaces." Iron Age 67(March 7, 1901): 11.

U.S. Steel Drawings: AH-2303 (nd., revised 1908), AH-7802 (1926, revised 1927), AH-20812 (1968, revised 1971).

Wall, Joseph Frazier. Andrew Carnegie. Pittsburgh: University of Pittsburgh Press, 1989, 788-793.

"World's Pig Iron Record Beaten." Iron Age 68(November 28, 1901): 33.

Historic Name: U. S. Steel, Homestead Works, Carrie No. 3 and No. 4 Turbo-Generator, Boiler House
Present Name: Park Corporation, Carrie Furnaces, Turbo-Generator, Boiler House
Location: Rankin, Allegheny County, PA
Construction: ca. 1901, 1920
Documentation: Photographs of the Carrie Blast Furnace Plant can be found in HAER No. PA-200-A.

DESCRIPTION

This 85' high building was built in two stages, the first, the southwest end, is 270' x 60' and the second is 108' x 60'. Constructed of exposed structural steel with brick infill, the building has a corrugated metal roof with monitor. The original section has two rows of narrow multi-story segmental arched windows (many of which are bricked up), and six 235' high smoke stacks which rise from the northwest side. The addition has five rows of top-hinged shutters including the monitor and a corbelled gable end. The interior was unavailable for inspection.

HISTORY

The Turbo-Generator Boiler House was originally constructed about 1901 to house the blowing engines for Carrie No. 3 and No. 4. These blowing engines were powered by steam from a boiler house located between cast houses No. 3 and No. 4. The 1920 addition was constructed for six gas-fired boilers needed to supply the first 15,000 kw turbo-generator in the adjacent Turbo-Generator Building. In 1924, a second turbo-generator was installed as part of the modernization of the structural mills, and six turbo-blowers were installed in what is now the oldest part of the No. 3 power plant to provide cold blast for Carrie Nos. 1, 2, 3, 4, 5. The turbo-blowers replaced the reciprocating blowing engines in the Turbo-Generator Boiler House, and freed up space for new coal-fired boilers needed for a second 15,000 kw turbo-generator.

Sources:
Menk, C. A. "Electrical Installations New Structural Mills, Homestead Steel Works, Carnegie Steel CO., Munhall, Pa.," AI&SEE Yearly Proceedings (1927), 214-227.

U.S. Steel Drawings: FM-100 (1946, revised 1980), AH-12991 (1923, revised 1924), and AH-10902 (1947).

Historic Name: U.S. Steel, Homestead Works, Carrie Furnaces, Turbo-Generator Building.
Present Name: Park Corporation, Carrie Furnaces, Turbo-Generator Building.
Location: Rankin, Allegheny County, PA
Construction: 1901, ca. 1918, 1920, 1925
Documentation: Photographs of the Carrie Blast Furnace Plant can be found in HAER No. PA-200-A.

DESCRIPTION

The turbo-generator building measures 280' x 50' and consists of a steel frame, brick infill structure built in four stages, but forming three parts. The remaining original section (1901) and the first extension (1918) comprise the southwest end, and have riveted compound Fan roof trusses with a corrugated cement asbestos roof. This section is 45' tall. The two story middle section (1920, 1925), is 90' high with exposed steel beams and brick infill. A flat Pratt truss with sloped upper cords supports the upper level. The truss supporting the roof of the middle section is a similar Pratt roof truss. Projecting out from the second level is a two-story metal shed that protects the electrical cables leaving the building. The third section (1920) is a seven-story brick and reinforced concrete addition to the northeast facade containing a stairwell with elevator, switch gear, parts storage, lockers and offices. The building also has a basement which is connected to the adjacent Pump House by a tunnel. All floors are concrete. The machinery includes two steam-turbines driving two 15,000 kw AC generators manufactured by GE and Westinghouse, three Westinghouse motor-generator sets, and four two-stage air compressors. The second level of the central section contains numerous partially demolished transformers. The machinery in the partly flooded basement includes electric and steam-powered pumps.

HISTORY

Located next to the Carrie No. 3 and No. 4 boiler house, the turbo-generator building provides AC power for the Homestead Works. Often referred to as the DC powerhouse, the building once contained several steam-driven DC generators. The timing of the conversion to AC is unclear, but the first extension was presumably tied to the installation of the 110" plate mill in 1917-18. The second 15,000 kw turbo-generator was added to power the 1925 structural mill.

Sources:
Carnegie Steel Company. General Statistics and Special Treatise on the Homestead Steel Works. Pittsburgh: Carnegie Steel Company, 1912, and 1921. Hereafter cited as General Statistics.

Menk, C.A. "Electrical Installations New Structural Mills, Homestead Steel Works, Carnegie Steel CO., Munhall, Pa." AI&SEE Yearly Proceedings (1927): 214-227.

"The Liberty Mill of the Carnegie Steel Co." Iron Age 101(January 3, 1918): 18-22.

U.S. Steel Drawings: FM-100(1946, revised 1980), AH-10386(1946).

Historic Name: U.S. Steel, Homestead Works, Carrie Pump House.
Present Name: Park Corporation, Carrie Furnaces, Carrie Pump House
Location: Rankin, Allegheny County, PA
Construction: 1901, 1906
Documentation: Photographs of the Carrie Blast Furnace Plant can be found in HAER No. PA-200-A.

DESCRIPTION

The Carrie Furnace pump house is a 170' long x 55' wide x 36' high, brick-clad steel framed building constructed in two stages. Tall narrow windows with segmented arches provide light to the interior. The eaves have corbelled brickwork. The foundations are brick. The pumps are located in the basement with access to the valves via a ground-level catwalk. The northwest half of the pump house is the original structure and the roof has riveted Fink trusses with laced bottom chords; web plates serve as knee braces. The 1906 section has riveted Fink trusses with laced bracing above the craneway. The craneway columns taper as they approach the foundations. Machinery includes a 17,350 gpm Wilson-Snyder pump powered by a 2000 hp electric motor; two 1250 hp Elliot steam turbines powering two 17,340 gpm Worthington pumps; a Westinghouse 150 hp AC motor with missing pump; a 900 hp Terry steam turbine (Hartford, Connecticut) with missing pump; a 1000 hp Allis-Chalmers AC motor; and a 17,350 gpm Wilson-Snyder pump. In 1938 the Pump House was rated at 100,000,000 gallons per day.

HISTORY

The construction of the pump house was concurrent with the construction of furnaces No. 3 and No. 4, and No. 6 and No. 7, and supplied cooling and process water to the Carrie plant. The pumps drew water from a 7' diameter inlet tunnel connected to the river. The foundations of a standpipe are located to the southwest of the building.

Source:
U.S. Steel Drawings: FM-100 (1946, revised 1980), CE-4004-A (nd, revised 1938)

Historic Name: U.S. Steel, Homestead Works, Carrie Furnaces, Steam Department Office.
Present Name: Park Corporation, Carrie Furnaces, Steam Department Office.
Location: Rankin, Allegheny County, PA
Construction: 1925
Documentation: Photographs of the Carrie Blast Furnace Plant can be found in HAER No. PA-200-A.

DESCRIPTION

The Steam Department Office is a 55' long x 27' wide x 24' high, brick building with shallow pilasters. The hip roof sheathed with wood is supported by a riveted steel truss consisting solely of the "fan" part of a compound fan truss. Lockers are located on the first floor and the office is on the second floor.

HISTORY

This office building was constructed when the site's steam and electric generation capacity was expanded to supply the new structural mills with electric power.

Sources:
U.S. Steel Drawing: FM-100 (1946, revised 1980).

Historic Name: U.S. Steel, Homestead Works, Carrie Machine Shop, ("The Little Shop").
Present Name: Park Corporation, Carrie Furnaces, Carrie Machine Shop.
Location: Rankin, Allegheny County, PA
Construction: 1902
Documentation: Photographs of the Carrie Blast Furnace Plant can be found in HAER No. PA-200-A.

DESCRIPTION

Approximately 130' long x 90' wide x 60' high, the machine shop is a three-bay steel-frame building with corbelled brick infill. The main bay is covered with riveted Fink trusses and the side bays are spanned by half-Fink trusses. Glazed sliding sash in the clerestory and tall glazed windows with segmental arches provide light to the interior. Concrete floors were inserted in the upper halves of the side bays in 1911 and 1940. A concrete-block office was added to the north corner of the interior in 1950.

Proceeding clockwise in a large "U" around the main bay from the main entrance, the machinery includes a G.A. Gray Co., Cincinnati, Ohio, extra heavy planer with a 3' x 10' horizontal bed; an 8' vertical boring mill manufactured by Niles, Bemont, Pond, at the Niles Tool Works, Hamilton, Ohio; Cohburn drill press; a radial arm drill press with two work areas 90 degrees apart; a 24" grinder manufactured by U.S. Electric Tool, Cincinnati, Ohio; a lathe with 10" chuck and 10' long bed; a 12" chuck x 18' long lathe; a dual-wheel 30" grinder; a universal shaping saw, Peerless Machine Co., Racine, Wisconsin; a shaper manufactured by Gould & Eberhardt, Newark, New Jersey; and a lathe, 16" chuck x 12' long, with the name Williams cast into the frame.

HISTORY

Located adjacent to the former site of Carrie No. 1, this machine shop did repair work for the Carrie Furnaces. It was called the "Little Shop" to distinguish it from the "Big Shop" in the steel works. The machine tools are among the oldest at the Homestead Works (some them may have once been shaft-driven).

Sources:

"Homestead Repair Shops Are Interesting." Iron Trade Review 56(April 1, 1915): 659-65.

U.S. Steel Drawings: FM-100 (1946, revised 1980), AH-1598 (1902).

Historic Name: U.S. Steel, Homestead Works, No. 3 Power Plant.
Present Name: Park Corporation, Carrie Furnaces, No. 3 Power Plant.
Location: Rankin, Allegheny County, PA
Construction: ca. 1883, 1941, 1952-53, 1957-59, 1976
Documentation: Photographs of the Carrie Blast Furnace Plant can be found in HAER No. PA-200-A.

DESCRIPTION

The No. 3 power plant is a 300' x 200' complex of seven interconnected structures which generate steam, AC power, and cold-blast. The facility also cleans stack air and burns waste gas. These interconnected structures are the No. 3 and No. 4 boiler houses (1941, 1952), the turbo-generator room (1941), the No. 1 and No. 2 high pressure turbo-blowers (ca. 1950), the turbo-blower building (which may be the 1901 boiler house for Carrie No. 1 and No. 2 — the turbo-blower units (6) date to 1924), and the No. 3 and No. 4 electrostatic precipitators (1976).

All but the low pressure turbo-blowers and the precipitators are housed in a steel-frame building clad with corrugated metal on both sides of an insulating layer. The roof over the turbo-generator and high-pressure boilers is supported by a flat Pratt-truss with a sloped top-chord. A peaked skylight extends over the turbo-generator. The low-pressure turbo-blower building is steel-framed, with exposed beams, corbelled-brick infill, monitor roof, and riveted steel Fink trusses. The main work floor of the complex is one story above ground level and is supported by reinforced concrete piers. The boilers are four-drum water-cooled furnaces with economizer and superheaters.

In 1941 the No. 3 boiler, manufactured by Riley-Stoker of Worcester, Massachusetts, was rated at 450,000 lbs. of steam per hour, 585 psig at 750°F. Both boilers burn cleaned blast-furnace gas supplemented with pulverized coal as needed to maintain uniform output. Steam from the No. 3 boiler powers the 1500 rpm, 32,000 kw (nominal rating) Allis-Chalmers steam turbine which in turn powers a 40,000 kva, 25 cycle, 13,800 v, Westinghouse AC generator. The steam is condensed by a 35,000 sq. ft. two-pass surface condenser. Boiler No. 4, identical to No. 3, powers two Ingersoll-Rand turbo-blowers. Producing 125,000 cfm at 44 psi, one high-pressure blower supplies both Carrie No. 3 and No. 4, while the second is held in reserve. Six low-pressure turbo-blowers, also manufactured by Ingersoll-Rand, produce 52-55,000 cfm of cold blast at 20-18 psi. Each low-pressure turbo-blower has a 16,000 sq. ft. Worthington condenser installed between 1955 and 1956. Four of the six turbo-blowers supply cold blast to Carrie No. 6 and No. 7. The remaining two are spares. Exhaust from the boiler's stacks are taken to the precipitators where air-borne combustion products are removed. Excess blast-furnace gas is burned by a gas-bleeder stack.

HISTORY

The larger part of the No. 3 power plant stands on the site of Carrie No. 5. The existing low-pressure turbo-blower building, however, stands on the site of the original Carrie No. 1 and No. 2 blowing-engine building and may incorporate part of the original structure. A boiler building that once stood to the immediate southwest provided the steam for the blowing engines. Additional blowing capacity was added with the construction of Carrie No. 5 on the northeast side of the building in 1902-03. The steam-powered blowing-engines were replaced with the existing turbo-blowers in 1924. Carrie No. 5 was taken off line in 1929 and demolished in 1937. The Carrie No. 5 site was chosen for a new power plant in 1941 because its central location offered room for additional expansion. The No. 3 boiler and the turbo-generator were over-designed to meet the repeated and severe load oscillations of the 100" Plate Mill and the Defense Plant rolling mills. The high-pressure turbo-blowers were installed in conjunction with the rebuilding of Carrie No. 3 and No. 4 to 28' hearths in the 1950s.

<u>Sources</u>:

Ames, Clifton C. USX/Kobe Steel. Interviewed by author, May 11, 1990.

"New Power House at Carrie Furnace." <u>Iron and Steel Engineer</u> 18(September 1941): 104-09.

Sanborn, <u>Braddock, Pennsylvania</u>, 1896.

Slater, Bill. Superintendent, Carrie Furnaces, 1969-1978. Interviewed by author, August 30, 1989 and June 7, 1990.

U.S. Steel Drawings: AH-200 (1894), FM-100 (1946, revised 1980)

<u>Historic Name</u>: U.S. Steel, Homestead Works, Carrie Furnaces, Stationary Car Dumper
<u>Present Name</u>: Park Corporation, Carrie Furnaces, Stationary Car Dumper
<u>Location</u>: Swissvale, Allegheny County, PA
<u>Construction</u>: ca. 1925
<u>Documentation</u>: Photographs of the Carrie Blast Furnace Plant can

be found in HAER No. PA-200-A.

DESCRIPTION

Manufactured by the Wellman-Seaver-Morgan Company of Cleveland, Ohio, this stationary car dumper is about 60' in height with a steel-frame structure measuring approximately 60' x 50'. A locomotive pulls cars from marshalling yards onto a pivoting L-shaped cradle. Four 150-hp motors, located in the winch-house, lift the cradle with the help of counterweights. The ore is dumped into a bin equipped with an overflow chute. The bin permits continued operation of the dumper while the transfer car takes the ore to the ore yards. Hand-operated water sprays are used to remove any ore that sticks to the bottom of the cars.

HISTORY

The Stationary Car Dumper was probably erected in late 1925 during U.S. Steel's major renovation of the Carrie Furnaces. This renovation work centered on blast furnaces No. 3 and No. 4, and No. 6 and No. 7, as well as the ore handling facilities of the four furnaces. (At this time apparently no work was done on Blast Furnace No. 5; it was blown out in 1929 and demolished a few years later). Prior to construction of the Car Dumper at No. 6 and No. 7, a stationary car dumper, probably manufactured by Brown Hoisting Machinery Company of Cleveland, Ohio, stood at No. 3 and No. 4, and served all of the ore yards. The Wellman-Seaver-Morgan car dumper of 1925 superseded this older structure which was either demolished or sold and removed. The 1925 car dumper served the ore yards at No. 3 and No. 4, and No. 6 and No. 7 until U.S. Steel closed down the Carrie Furnaces in the early 1980s. The stationary car dumper remains in place and may be one of the oldest surviving car dumpers in the United States.

Sources:

Cowles, W. L. "Handling Ore at a Blast Furnace." Cassier's Magazine 22(June 1902): 157-74.

Lose, James E. "The Operation of Large Hearth Furnaces Using Coke Made from One Hundred Per Cent High Volatile Coal." American Iron and Steel Institute Yearbook (1927): 79-102.

Miller, Keith. McNally-Wellman Company. Interviewed by author, August 17, 1990 and January 25, 1991.

Historic Name: U.S. Steel, Homestead Works, Carrie No. 6 & No. 7 Ore Bridge, Ore Yard, and Stockhouse

Present Name: Park Corporation, Carrie Furnaces, Carrie No. 6 & No. 7 Ore Bridge, Ore Yard, and Stockhouse
Location: Swissvale, Allegheny County, PA
Construction: 1906, 1951
Documentation: Photographs of the Carrie Blast Furnace Plant can be found in HAER No. PA-200-A.

DESCRIPTION

The ore bridge used at Carrie No. 6 and No. 7 rises about 100' in height. Built by Dravo Engineering and American Bridge in 1951, the ore bridge spans 186'. Its superstructure is composed of a riveted steel Warren truss, supporting a 15-ton ore bucket. Two 94-hp motors propel the trolley and a 250-hp motor lifts the bucket. The ore is brought to the ore yard from the car dumper by transfer cars on rail lines sunk below the riverside wall of the ore yard. The bucket fills a hopper suspended from the bridge above the stockhouse which in turn empties into a bin car that keeps the stockhouse ore-bins full. The ore bridge also sorts and mixes the ores in the ore yard.

The stockhouse is a 30' high x 550' long x 38' wide structure constructed of a series of concrete arches (some of which are clad with brick). Flux and ore are stored in a row of bins serviced by the ore bridge. The coke is stocked in bins immediately above each skip hoist. It is brought from Clairton and dumped directly into the bins. The stockhouse contains coke screens, coke breeze skip hoists, and scales needed to supply the skip hoists of the blast furnace.

HISTORY

The current ore bridge replaced two 7 1/2-ton bridges installed in 1906. American Bridge fabricated the main span, while the Dravo Corporation, a regional construction firm, fabricated the rest of the ore bridge. The new ore bridge remained in use until U.S. Steel closed the blast furnace plant in the early 1980s. The Stockhouse has been lengthened several times over the life of the furnaces in support of production increases.

Sources:
"New Ore Bridge." Iron and Steel Engineer 28 (November 1951): 175.

Slater, Bill. Superintendent of the Carrie Furnaces, 1969-1978. Interviewed by author, October 18, 1990.

U.S. Steel Drawing: AH 15227 (1951).

Historic Name: U.S. Steel, Homestead Works, Carrie No. 6 and Carrie No. 7
Present Name: Park Corporation, Carrie Furnaces: Carrie No. 6 and Carrie No. 7
Location: Swissvale, Allegheny County, PA
Construction: 1906, 1925, 1936
Documentation: Photographs of the Carrie Blast Furnace Plant can be found in HAER No. PA-200-A.

DESCRIPTION

Carrie No. 6 and No. 7 are laid out on two axes to accommodate a bend in the river. As a result the stockhouse, skip hoists, hoist houses and hot-blast stoves of No. 6 and No. 7 are at an angle with the rest of the Carrie Furnace plant. The hoist houses are 40' square, 30' high, steel frame and brick buildings raised on steel columns. These corrugated metal roofed buildings house the hoist and furnace bell machinery including: Otis winches with 350-hp motors for the skip hoists, 4' and 3' diameter pneumatic cylinders to raise and lower the furnace's bells, and air receivers. Each furnace has ten round mantle posts, sixteen tuyeres, an iron notch, two slag notches, and 23'-6" diameter hearths. Both furnaces have limited stack cooling plates because of their relatively small working volume of 31,558 cubic feet. Double-bell McKee tops and four gas-uptakes with individual bleeder valves complete the furnace stacks.

Of the two cast houses, only the one connected to No. 6 is intact. The steel-framed building measures 175' x 60', and is about 60' tall. The steel plate roof is supported by riveted-steel cambered-Fink trusses. The concrete and brick cast-house floor is one story above ground level to allow torpedo cars to pull up under the iron runners. Cast house facilities include a mud-gun control-house, steel cable-operated iron-runner gates, a mud gun, a tap-hole drill, and a waste bin. The slag runner descends to a section of the cast house with two dormer-like gables, and wraps around the rear of the cast house. The molten slag runs into a water spray which solidifies the slag into granules. A refractory-brick lined water-flume carried the solidified slag behind furnace No. 7 to a cinder pit. Only the part of No. 7 cast house that is immediately adjacent to the furnace remains, as does the mud gun.

Each blast furnace has three double-pass hot-blast stoves with lateral combustion chambers exhausting the combustion gases to a stack adjacent to No. 7. The hot-blast stoves of No. 6, which are the three closest to the river, are taller than those of No. 7. Both sets of hot-blast stoves are reinforced with welded steel lozenges. The stoves heated the blast to about 1100 degrees F.

Gas for the hot-blast stoves and for the boilers is cleaned by dust collectors, gas washers, electrostatic precipitators, and a thickener. S. P. Kinney of Carnegie, Pennsylvania, manufactured the washers in 1968. Research-Cottrell Inc. of Bound Brook, New Jersey, made the precipitators in 1956. Gas which had its heaviest particles removed by the sudden drop in pressure and flow reversal of the dust collector is sent to the washer. In the washer the gas rises through horizontal banks of perforated ceramic tile while being sprayed with water. From the washer, the gas goes to the precipitators where it passes through oppositely charged metal tubes with wire electrodes strung along their vertical axis. The dust that collects on the sides of the tubes is washed down to the thickener underneath the precipitators by water sprays. A slowly revolving rake in the thickener collects the sediment. Sediment was pumped from the thickener to the now demolished filter cake house. The washers have a capacity of 90,000 cubic-feet-per-minute (cfm), while the precipitators clean 93,000 cfm.

HISTORY

Carrie No. 6 and No. 7 are remarkably well preserved examples of 1920s-1930s blast furnace technology. Construction of No. 6 and No. 7 began in 1906 and the furnaces were blown in on June 4 and August 3, 1907 respectively. The furnaces had 22' boshes and each was equipped with four Massicks & Crooke three-pass stoves. Dust catchers, primary washers, baffle washers, screen washers, and Theissen rotary washers were installed at that time to provide clean gas for the gas-burning blowing engines, generators, and hot-blast stoves.

The blast furnaces and auxiliary facilities were rebuilt in 1925-26 in response to trends toward higher blast pressures, increased use of soft Mesabi ores and the high-volatile by-product coke produced at Clairton. In addition to increasing the bosh to 24'-9", No. 6 and No. 7 were given 21'-6" hearths, Feld gas washers and enlarged gas-powered blowing engines. Both the hearths and the boshes were increased to 22'-6" and 25'-6", respectively, during a 1928 reline that further reflected the trend toward soft ores and larger furnaces.

The two furnaces were rebuilt again in 1936, at the same time the 100" Plate Mill went on line, and shortly before Carrie No. 5 (taken off line in 1929) was dismantled. Changes made as part of the 1936 renovation includes 23'-6" hearths, 27'-0" boshes, the replacement of the eight three-pass stoves with six larger, two-pass stoves, dust collectors, gas washers, and furnace tops equipped with four instead of the previous two uptakes. With the exception of the addition of the precipitators, thickener, and Kinney gas washers, the 1936 reconstruction comprises the current installation. In 1956 part of the blowing engine building totalling about 80' of the southwest end was demolished to make way for the precipitators; the current gas washers were installed during furnace relining in 1968.

Sources:
Directory (1907), 6; (1935), 84; (1977), 300.

Lose, James E. "The Operation of Large Hearth Furnaces Using Coke Made from One Hundred Per Cent High Volatile Coal." American Iron and Steel Institute Yearbook (1927): 79-102.

Slater, Bill. Superintendent of the Carrie Furnaces, 1969-1978. Interviewed by author, August 30, 1989.

U.S. Steel Corporation. The Making, Shaping and Treating of Steel. Pittsburgh: 1951, 294-316. Hereafter cited as Making.

U.S. Steel Drawings: AH-12861 (1908), AH 16894 (1956), AH 2542 (1906, revised 1951), AH 21153 (1968), AH 2275 (ca. 1906), AH 9051 (1936), AH 9483 (1937).

Historic Name: U.S. Steel, Homestead Works, Carrie Furnaces, Blowing Engine House
Present Name: Park Corporation, Carrie Furnaces, Boiler Shop
Location: Swissvale, Allegheny County, PA
Construction: 1907
Documentation: Photographs of the Carrie Blast Furnace Plant can be found in HAER No. PA-200-A.

DESCRIPTION

Measuring 220' x 104' the Carrie boiler shop is a 84' high steel-frame building with brick and corrugated metal walls and a concrete floor. Riveted steel roof trusses (a modified Fink type) support the monitor roof. Two rows of narrow windows with segmental arches extend along the building on all but the southwest side. The steel frame is exposed on the long sides, but enclosed in shallow brick pilasters on the northeast gable end. Brick corbelling extends below the gable eave. The southwest end was shortened 80' in 1956 to make room for the precipitators and the gable end is closed with sheet metal. The roof is sheet metal, and sheet metal covers the fixed louvers of the monitor. The interior contains a blacksmith shop equipped with a steam hammer, two natural gas forges, and a locker room.

HISTORY

The boiler shop was constructed in 1907 to house blowing engines for Carrie No. 6 and No. 7. Manufactured by Allis-Chalmers the four blowing-engines were "horizontal, four-cycle double acting, twin-tandem" engines each with "four gas cylinders 42 x 54 inches and two air cylinders 72 x 54 inches". Two steam-powered twin-cylinder compound horizontal blowing-engines completed the plant. Steam for the engines was produced by blast-furnace gas fed boilers located in the current Spare Parts Building. These blowing engines were probably taken off-line with the installation of the high pressure turbo-blowers in the No. 3 Powerhouse during the mid-1950s. At that time, or shortly thereafter, the lower pressure turbo-blowers which served Carrie No. 2 and No. 5 were used to supply No. 6 and No. 7. Several of the blowing engines were presumably removed when about 80' of the southwest end of the building was demolished in 1956 to make way for the electrostatic precipitators.

<u>Sources</u>:

U.S. Steel Drawings: FM-100 (1946, 1980), AH-2722 (1906, revised 1927).

<u>Directory</u> (1912), 144, (1954), 158, (1960), 316.

Lose, James E. "The Operation of Large Hearth Furnaces Using Coke Made from One Hundred Per Cent High Volatile Coal." <u>American Iron and Steel Institute Yearbook</u> (1927): 79-102.

<u>Historic Name</u>: U.S. Steel, Homestead Works, Carrie Furnaces, AC Power House
<u>Present Name</u>: Park Corporation, Carrie Furnaces, Spare Storage
<u>Location</u>: Rankin and Swissvale, Allegheny County, PA
<u>Construction</u>: 1906, 1909, 1917
<u>Documentation</u>: Photographs of the Carrie Blast Furnace Plant can be found in HAER No. PA-200-A.

DESCRIPTION

The spare storage building is 72' high, 377' x 90' (including 88' and 66' additions) with a steel frame and brick structure. The riveted trusses are a variation on a modified Fink. Two rows of narrow windows with segmental arches, now blocked with brick, extend along the length of the building. The southwest gable end is brick with pilasters and corbelled eaves, while the northeast gable is corrugated metal. The roof is corrugated metal and the floors are concrete. The building contains a miscellany of parts and spares, remains of switch gear, air compressors, and motor-generator sets.

HISTORY

The spare parts building was constructed to generate AC power. Cleaned blast furnace gas from Carrie No. 6 and No. 7 supplied gas-engine powered generators probably manufactured by Allis-Chambers and Bethlehem. There were a total of six such gas engines by 1921. Expansion of the building corresponds to the installation of the Slick car wheel facility and the 110" plate mill — facilities which required additional AC power. The building has been used for storage for an undetermined period of time.

Sources:
General Statistics, (1921).

"Operation of Blast-Furnace Gas Engines." Iron Age (July 6, 1911): 36-39.

"The Liberty Mill of the Carnegie Steel Co." Iron Age 101(January 3, 1918): 18-22.

U.S. Steel Drawings: FM-100 (1946, 1980), AH-2317 (1906).

Historic Name: U. S. Steel, Homestead Works, Monongahela River Hot Metal Bridge
Present Name: Homestead Hot Metal Bridge
Location: Rankin and Munhall, Allegheny County, PA
Construction: 1900
Documentation: Photographs of the Carrie Blast Furnace Plant can be found in HAER No. PA-200-A.

DESCRIPTION

The hot metal bridge spans the Monongahela River between the Carrie Furnaces and the Homestead Works, and consists of a massive Pennsylvania through-truss main span, a Baltimore through-truss span to the north, and multiple steel-plate girder approach spans to the north and south. The main span measures 500' in length and rests on ashlar sandstone piers. The Baltimore through-truss span measures 252' in length and also rests on ashlar sandstone piers. The hot metal bridge carries two sets of track and its total length of 2,300' includes the truss and plate girder approach spans. The bridge is in good condition. The downstream track is equipped with high steel walls with a cement or refractory lining to protect against iron spills.

HISTORY

Prior to the construction of this hot metal bridge, the Duquesne Furnaces supplied the Carnegie Steel Company's Homestead Works with molten pig-iron. Around 1900 Carnegie Steel designed a new layout for its Union Railroad to transport hot metal directly from its Carrie Furnaces to the Homestead Works, as well as supply the blast furnaces with ore and raw materials that was being handled by the Baltimore and Ohio Railroad. Central to this design was a new bridge across the Monongahela. Carnegie Steel contracted with its subsidiary, the American Bridge Company, Keystone Bridge Works, to build the multi-span structure. Because of the substantial length of the main span, totaling 500', and the tremendous live load imposed by the hot-metal railroad cars, the bridge was constructed with extremely heavy structural steel sections. The top (compression) chord of the main span measures 48" in width and 36" in depth, about one-and-one-half times the size of a typical top chord for a bridge with a similar span.

The Keystone Bridge Works completed construction work in just a few months and the bridge opened in late 1900, about the same time that Jones & Laughlin completed construction of a hot metal bridge over the Monongahela in Pittsburgh. The Carrie Furnaces-Homestead Works hot metal bridge remained in service until 1984 when U.S. Steel blew out No. 3 and No. 4 furnaces — the last furnaces in operation at Carrie. Iron for Homestead's open hearths was shipped from Duquesne until the entire works shut down in 1986. The abandoned bridge remains in good condition.

Source:
"Hot Metal From Rankin to Homestead." Iron Trade Review (October 25, 1900): 15.

STEELSHAPING - PLATE MILLS

Historic Name: U.S. Steel, Homestead Works, 45" Plate Mill Soaking Pits
Present Name: Park Corporation, Homestead Works, 45" Plate Mill Soaking Pits
Location: West Homestead, Allegheny County, PA
Construction: ca. 1942, 1951, 1957, 1968
Documentation: Photographs of the 45" Plate Mill can be found in HAER No. PA-200-B.

DESCRIPTION

The 45" Mill Soaking Pits Building is a 75' high, one-story steel-frame structure measuring about 839' long (including three additions totaling 277' in length) x 100' wide. The building incorporates riveted steel, fan-type Fink roof trusses, a monitor roof, corrugated metal siding, and both corrugated metal and corrugated cement asbestos roofing. The lower panels on the northwest side of the building are open to help disperse the heat. A 16' wide one-story side-bay runs along the southeast side of the building. A strip of fiberglass panels admits light below the trusses of the side-bay. The Soaking Pit Building contains the control rooms and duct work for seventeen pairs of soaking pits manufactured by the Amco Furnace Division of the Amsler Morton Company. The furnaces and the ingot buggy have been demolished or scrapped.

HISTORY

The soaking pits equalize the internal temperatures of the stripped ingots in preparation for rolling in the 45" Slabbing Mill. Built by the Defense Plant Corporation, the initial installation had ten pairs of bottom-fired recuperative soaking pits each measuring 15' x 16', with a depth of 13'. The most important of the three expansions was in 1957, when 188' was added to the building.

Sources:

"Carnegie-Illinois Pittsburgh Expansion Near Completion." Iron Age 153 (January 27, 1944): 92.

"Engineering News at a Glance: Record Slab Output." Steel 121 (July 28, 1947): 82.

Ericson, A.G. "Universal Slabbing Mill Differs from Most Designs." Steel 116 (January 8, 1945): 108, 110.

Ericson, A.G. "Universal Slabbing Mill Will Roll All Grades of Steel Including Stainless and Alloy." Blast Furnace and Steel Plant 33 (January 1945): 111-13.

Steel Mill, Homestead, Pennsylvania, Plancor 186-H. Record Group 234, National Archives. Hereafter cited as Plancor.

Historic Name:	U. S. Steel, Homestead District Works: 45" Universal Slabbing Mill Building
Present Name:	Park Corporation, Homestead: 45" Universal Slabbing Mill Building
Location:	West Homestead, Allegheny County, PA
Construction:	ca. 1942
Documentation:	Photographs of the 45" Mill can be found in HAER No. PA-200-B.

DESCRIPTION

The 45" Mill Building, a continuation of the 45" Mill Soaking Pit Building, is 420' x 100' and about 75' high. Housing the remains of the 45" universal slabbing mill and its auxiliaries, the building incorporates riveted-steel, fan-type Fink roof trusses, a monitor roof, corrugated metal siding, and corrugated cement asbestos roofing. With the exception of the universal mill itself, most of the machinery is intact. Intermittent panels of fixed louvers above the crane level of the southeast wall provide additional ventilation. A crane way, exposed for most of its length, runs along the outside of the southeast side of the building and serves coke breeze, scale pits, and crop ends. A cinder-block wall divides the 45" Mill Building from the 45" Mill Motor Room on the northwest. Ingots were weighed, rolled, scarfed, and sheared before the resulting slabs were sent to one of three slab yards for storage. The ingot scale/turner and the horizontal stand of the rolling mill has been scrapped. Parts of the vertical roll stand, as well as the horizontal spindles, are scattered throughout the building.

The 3000 hp Westinghouse DC reversing motor for the vertical rolls is still mounted on its approximately 20' high hollow concrete tower. The hollow of the tower was connected through the basement to the air-cooling system of the adjacent 45" mill motor room. The vertical roll stand is the equivalent of a 36" blooming mill placed on its side. After rolling, a Linde oxyacetylene scarfer removes surface defects from the slabs by burning off a layer of metal. When originally installed, the scarfer only scarfed edges, but it was later upgraded to clean all four sides of the slab. Exhaust from the scarfer is sent to a conical-shaped dust catcher before it is further cleaned by an electrostatic precipitator located in Slab Yard A. Manufactured by Aerotec Corp., the precipitator was installed by 1965. After scarfing the slab is cut to length by a upcut hydraulic slab shear. Three Worthington 4500 psi reciprocating oil pumps located in the basement supply hydraulic oil at 4500 psi to a 40" diameter cylinder. A mechanical gauge guide over the roll table controls the slab length. The slabs are piled onto a transfer car by a hydraulically lifted roll table. Transfer cars connect the 45" Mill with Slab Yards A and B. Slabs intended for storage in slab yard C are moved by overhead crane.

HISTORY

About 1942 United Engineering designed and built the 45" slabbing mill for the Defense Plant Corporation. The mill rolled every grade of slabs ranging from approximately 3" to 22" thick and between 19" and 67" wide. Each of the 45" diameter x 80" wide horizontal rolls were directly connected to a 5,000 hp DC reversing motor by universal joint spindles. In a paper published in Iron and Steel Engineer, Homestead's chief engineer cited the horizontal rolls as the first use of roller bearings, as opposed to bronze or babbitt bearings, in a primary mill. Counterweights kept the upper roll in contact with the screwdowns that controlled the distance between the rolls. The vertical rolls were equipped with bronze bearings because roller bearing technology was not sufficiently developed at the time.

In the early 1950s, when the 32" Slabbing Mill was shut down, the 45" Mill was the sole source of slabs for the 48", 100" and 160" Plate Mills. The use of universal mills for slabbing was superseded by the development of the high-lift blooming/slabbing mill such as the 46" mill at Duquesne. The mill began operation in January 1944 and shut down in the early 1980s. A similar, but slightly smaller, slabbing mill was installed at the Edgar Thomson Works in 1938.

Sources:

"Carnegie-Illinois Pittsburgh Expansion Near Completion." Iron Age 153 (January 27, 1944): 92.

Ericson, A.G. "The Universal Slabbing Mill at Homestead." Iron and Steel Engineer 22 (March 1945): 35-46.

Kruse, A.R. "Modern Universal Slabbing Mills." United Effort 28 (May 1948): 3-5.

Making (1964), 635.

"New DPC Plant Nears Completion." Steel 114 (January 24, 1944):

31.

Plancor.

Historic Name: U.S. Steel, Homestead Works, 45" Universal Slabbing Mill Motor Room
Present Name: Park Corporation, Homestead Works, 45" Universal Slabbing Mill Motor Room
Location: West Homestead, Allegheny County, PA
Construction: ca. 1942

DESCRIPTION

The 45" Mill Motor Room is approximately 48' high and measures 3312' x 65'. The building is constructed of structural steel with concrete-block infill, supporting a Warren truss with a single-slope roof. The major equipment has been removed.

HISTORY

The Motor Room once contained two Westinghouse 5,000 hp DC reversing motors, a flywheel set (composed of a 7,000 hp AC induction motor, a 15' flywheel, and three 3,000 kw DC generators), Ward-Leonard controls, exciter sets, and controls. A closed recirculating air-cooling system with precipitators was in the basement. Auxiliary DC power was provided by a 1500 kw motor-generator set linked to a mill-wide system. A dual motor drive, first used on the 54" blooming mill at U.S. Steel's South Chicago Works in 1928, produced faster reversal times, reduced maintenance through the elimination of the pinon stand, and compensated for any uneven wear on the rolls. The 3,000 hp DC motor, still in place in the adjacent 45" mill building, at the time of the survey, powered the vertical rolls, and was synchronized to the horizontal roll motors so that it neither pulled nor pushed the steel.

Sources:

Cramer, Frank W. "Twin-Motor Drives in Hot Reducing Mills." Iron Age 156 (October 11, 1945): 58-61.

Ericson, A.G. "The Universal Slabbing Mill at Homestead." Iron and Steel Engineer 22 (March 1945): 35-46.

Making (1952), 648-671.

Plancor.

Historic Name:	U. S. Steel, Homestead Works, 48" Plate Mill Building
Present Name:	Park Corporation, Homestead Works, 48" Plate Mill Building
Location:	Munhall, Allegheny County, PA
Construction:	1899
Documentation:	Photographs of the 48" Mill can be found in HAER No. PA-200-C.

DESCRIPTION

The 48" Universal Plate Mill is housed in a 60' high, 150' x 75' steel-frame building with riveted Fink trusses and monitor roof. Corrugated metal covers the roof and sides except for fiberglass panels in the monitor located above the crane way on the east, and below the crane way on the north. In addition to the mill and its engine, the building also contains an operator's pulpit, a scale pit, and a parts storage rack.

When installed, the 48" Universal Plate Mill was designed to roll universal plate 46" to 20" wide, 5/16" to 2" thick, and up to 150' long direct from slab ingots. Subsequent modifications permitted the mill to roll substantially narrower and a bit wider plate. The steel was worked by a set of horizontal rolls and two sets of vertical rolls (vertical rolls are the distinguishing feature of a universal mill). The horizontal rolls were 48" long and 31" in diameter. They were coupled to the pinion stand via spindles. An electric-driven belt powered the horizontal screwdowns. Counterweights under the stand kept the top roll against the screws. The 17-1/2" diameter vertical rolls had 25-1/8" long bodies and were mounted in bearing boxes. Power for the vertical rolls was taken off a gear extending from the engine side of the upper pinion. A set of gears divided this power and transmitted it to the vertical rolls via horizontal shafts and miter gears. Two electric motors, one for each set of vertical rolls, open and closed the rolls. The motor shafts rotate a series of interlocking gears which in turn rotate two horizontal screws for each vertical bearing box. A hydraulic system maintained contact between the bearing boxes and the screws. The approach table has a hydraulic manipulator. Extensive safety railings and platforms cover much of the top of the mill housing.

As with the roll stand, the steam engine was manufactured by Mackintosh-Hemphill and is a horizontal, non-condensing, double-acting, twin-cylinder, direct-connected reversing engine. Steam is admitted to the cylinders via piston valves, and the engine uses a Stephenson reversing mechanism. A weighted wheel located between the eccentrics balances the reciprocating mass. The 50" x 60" bore and stroke developed 5,850 maximum horsepower under test. Contract costs were $57,000 and $43,750 for the mill and the engine respectively. Between 1911 and 1922 the mill rolled an average 167,697 gross tons of plate per year.

HISTORY

Prior to its partial demolition, the 48" Mill consisted of several open-air slab yards, a reheating building, a shipping building, and the 48" mill building. These structures were laid out to fit a triangular shaped marshy depression on the upstream end of the plant. Extensive fill and foundation work was needed to support the weight of the complex.

Remarkably well preserved, the 48" universal plate mill and reversing engine are extremely rare. It has always been driven by its steam engine, and operated without substantial modification from 1899 to December 29, 1979. When construction plans were announced, the mill was to be the largest of its class ever built. Comparison of the machinery with surviving blueprints, and with photographs of the mill when it was installed suggests that minor changes were made in the 1930s, 1940s, and early 1970s. The horizontal screwdown readout dial, belt drive, and a simpler vertical screwdown gear system probably date to the first set of changes; the current pulpit, the hydraulic manipulator, an emergency steam cut-of valve, and the safety platform are part of the latter modifications. The slab yards, reheating furnaces, shear building, and shipping building constructed in 1899 are no longer extant.

Sources:

Harbord F. W. and J. W. Hall. The Metallurgy of Steel. Fourth edition, Volume II. London: Charles Griffin and Co., 1911, 674.

"Homestead Mill Updated." Iron and Steel Engineer 48 (June 1971): 96.

Mackintosh-Hemphill Co. Rolling Mills, Engines and Machinery for Iron and Steel Works. Pittsburgh, PA.: Mackintosh-Hemphill Co., 1909.

Making, (1920): 431-435.

"Mammoth Plate Mill to be Built at Homestead." Iron Trade Review 30 (December 23, 1897): 10.

Milster, Conrad. Stationary Engine Society. Interviewed by author, February 22, 1990.

Plant Description, 119.

Rick, Tom. Manitou Machine Shop. Interviewed by author, December 1990.

"The Homestead 48-inch Universal Plate Mill." Iron Age 66 (December 27, 1900): 1-2, 3, 4, 5.

Historic Name: U.S. Steel, Homestead Works, 100" Semi-Continuous Sheared Plate Mill
Present Name: Park Corporation, 100" Semi-Continuous Sheared Plate Mill
Location: West Homestead, Allegheny County, Pennsylvania
Construction: 1936
Documentation: Photographs of the 100" Plate Mill can be found in HAER No. PA-200-D.

DESCRIPTION

Completed in 1936, the 100" Plate Mill was essentially a semi-continuous strip mill without the final two finishing stands. It produced plate 20" - 98" wide, 3/32" - 5/8" thick, and up to 150' long. In 1937, the capacity was estimated at 729,000 gross tons per year. The 100" mill rolled slabs made by the 45" Universal Slabbing Mill into plate. The slabs were scarfed and stored in the slab yards before they were heated to rolling temperature in continuous furnaces. The hot slab passed through descaling, broadside, squeezing, roughing and finishing steps. A series of transfer tables sent the plate to one of four shear lines, a normalizing furnace, and the shipping buildings.

HISTORY

Construction of the 100" Plate Mill began in December 1935 and the mill went into production the following year. Built parallel and adjacent to the 1917 110" "Liberty" mill, the construction of the 100" mill required the demolition of several bays that stored structural beams downstream from the Howard Axle Works. The mill used continuous strip rolling technology developed in the 1920s to produce plate at high volumes and higher gauge tolerances. The 100" mill made the three-high 110" "Liberty" mill obsolete and the latter mill was shut down; its shear, shipping and office buildings were incorporated into the 100" mill.

During World War II the mill was significantly expanded. The slab yards were enlarged in conjunction with Defense Plant construction for the 45" Slabbing and 160" Plate mills. At this time, an additional slab heating furnace was installed, the roughing stand was widened, and many of the shear and shipping bays were extended. The mill's customers were primarily regional fabricators of tanks, barges, and girders. This customer base began to shrink in the 1950s. The mill was shut down in the summer of 1985 for lack of sufficient orders.

Sources:
Making (1940): 736; and (1951): 766.

"Reversing Roughing Unit with Vertical Roll Edger Features Homestead Sheared Plate Mill." Steel 100 (January 18, 1937): 38-43, 64.

Fenstermaker, Lloyd. Superintendent of the 100" Mill. Interviewed by author, May 14, 1990.

Historic Name: U.S. Steel, Homestead Works, 100" Plate Mill Slab Yard
Present Name: Park Corporation, Homestead Works, 100" Plate Mill Slab Yard
Location: West Homestead, Allegheny County, PA
Construction: 1940, 1942, 1944
Documentation: Photographs of the 100" Plate Mill can be found in HAER No. PA-200-D.

DESCRIPTION

The 100" Plate Mill Slab Yard measures about 600' x 110' and rises about 75'. The steel frame building has unidentified steel roof trusses, monitors, slag and dirt floors and it exterior walls are clad with corrugated metal.

Slabs were transferred to the 100" mill slab yard and stacked according to the rolling schedule after scarfing in Slab Yard A.

HISTORY

The original slab yard was about one quarter the size of the existing yard. A series of additions, alterations, and demolitions were made in 1940, 1942, and 1944 to meet wartime demands. No significant changes have been made to the slab yard since World War II.

Source:
U.S. Steel Drawing: FM 100, Part III (1945, 1980)

<u>Historic Name</u>: U.S. Steel, Homestead Works, 100" Plate Mill Continuous Furnace Building
<u>Present Name</u>: Park Corporation, Homestead Works, 100" Plate Mill Continuous Furnace Building
<u>Location</u>: West Homestead, Allegheny County, PA
<u>Construction</u>: 1936
<u>Documentation</u>: Photographs of the 100" Plate Mill can be found in HAER No. PA-200-D.

DESCRIPTION

The 200' x 150' Continuous Furnace Building is comprised of two one-story steel-frame bays clad in corrugated metal. Unidentified riveted steel roof trusses support open sided-monitor roofs. Hinged panels in the gables provide additional ventilation. Four double-row triple-fired continuous furnaces with carborundum recuperators heat 68 tons of slabs per furnace per hour to a rolling temperature of about 2250°F. The furnaces were manufactured by Rust Engineering of Pittsburgh.

HISTORY

Three of the furnaces were installed in 1936, with a fourth added in 1940 as part of the wartime expansion. (See general history at the beginning of this section for additional information.)

<u>Sources</u>:

<u>Making</u> (1951): 763.

"Reversing Roughing Unit with Vertical Roll Edger Features Homestead Sheared Plate Mill." <u>Steel</u> 100 (January 18, 1937): 38-43, 64.

U.S. Steel Drawing: MC-3610 (1940)

<u>Historic Name</u>: U.S. Steel, Homestead Works, 100" Plate Mill Building
<u>Present Name</u>: Park Corporation, Homestead Works, 100" Plate Mill Building
<u>Location</u>: West Homestead, Allegheny County, PA
<u>Construction</u>: 1936
<u>Documentation</u>: Photographs of the 100" Plate Mill can be found in HAER No. PA-200-D.

DESCRIPTION

This building is 600' long x 90' wide x 65' high, with a corrugated sheet-metal roof. The structure, which has almost no exterior walls, houses the 100" mill rolling equipment. The roof system is a riveted-steel fan type of Fink truss with monitor and glazed clerestory. An elevated walkway runs along the concrete block wall that separates the motor room from the mill building on the southeast. A multi-room concrete tunnel runs the length of the building and houses an extensive system for forced lubrication and hydraulic roll balancing.

The two-high scalebreaker has 36" diameter rolls that are 100" wide, and is equipped with 1000 psi water sprays. The descaled slabs are turned 90 degrees by a cross-shaped turntable. Two mechanical arms, each mounted on a frame above the roll table on either side of the broadside stand, squares the slabs and pushes them into the roll. The broadside stand is a four-high mill with 42" diameter rolls, 120" wide work-rolls, and back-up rolls 52" in diameter and 120" in width. As the slab passes through the mill, the rolls spread or widen the slab. After the spreading pass, a second turntable rotates the slab again so that the narrow edge of the slab enters a squeezer.

After spreading, the long sides of the slabs are irregular and need trueing in order to produce plate of consistent width. A complicated system of reducing gears and shafts force heavy guards against the length of the slab, while hydraulic cylinders hold the top of the slab against the roll table to prevent buckling. The slabs are reduced in the four-high reversing roughing mill with 36" diameter, 120" wide work rolls backed-up by 54" diameter, 120" wide rolls. Originally the approach side of the roughing mill had a set of vertical rolls 40" in diameter and 11" long. Several factors, however, including an edger in disrepair, a lack of customer demand for mill-rolled edges, and the reduced productivity caused by the edger's distance from the stand resulted in its removal in the 1970s. The plate was finished in four-high non-reversing stands with 27" diameter x 106" long work rolls and 54" diameter x 100" long back-up rolls. As the plate is reduced by each stand, the speed of the rolls is increased to compensate for elongation. When the mill rolled floor plate, the top work roll of the last finishing stand was cut with a pattern which left raised projections on the plate.

Water sprays after the last finishing stand cooled the plates before they were sent to the Runout Building. All of the stands are closed top casting and used anti-thrust roller bearings, except the scalebreaker and the broadside stand which have bronze-insert babbitt bearings. Hydraulic roll balance cylinders kept the upper rolls in contact with the screwdowns. Extensive electronic systems in the original installation provided automatic gauge control to the roughing stand, and a semi-automatic system was added to the last finishing stand.

HISTORY

United Engineering, which manufactured all the 100" Mill roll stands, claimed the roughing mill was "the first large 4-high reversing hot-mill ever installed in a tandem mill." During World War II, the roughing stand was widened from 90" to the current 120" so the stand could roll ship-plate for the Navy. These plates were not run through the finishing stands. Instead these plates were taken off the roll table after rolling in the rougher. (See general history at the beginning of this section for additional information.)

Sources:

"C-I Widens Homestead Roughing Stand to 120 In." Iron Age 147 (January 30, 1941): 78.

Fenstermaker, Lloyd. Superintendent of the 100" Mill. Interviewed by author, May 14, 1990, and November 5, 1990.

Making (1940): 737-741; (1951): 763-765.

"New Highs in Efficiency Seen in New 100-inch Semi-Continuous Sheared Plate Mill." United Effort 17(2): 3-18.

"Plate Mill Screwdown Control: Roughing Operations on New Homestead Plate Mill Are Controlled Automatically." Steel 100 (January 18, 1937): 44-46, 64.

Historic Name: U.S. Steel, Homestead Works, 100" Mill Plate Motor Room
Present Name: Park Corporation, Homestead Works, 100" Plate Mill Motor Room
Location: West Homestead, Allegheny County, PA
Construction: 1936
Documentation: Photographs of the 100" Plate Mills can be found in HAER No. PA-200-D.

DESCRIPTION

Riveted-steel Warren roof trusses span this steel-frame and concrete block building which measures 510' x 70'. The room is glazed above the clerestory on the southeast wall. The foundations and floors are concrete. A 1000 hp, 500 rpm AC motor manufactured by GE powered the scalebreaker. The broadside mill was powered by a Westinghouse 4500 hp, 370 rpm AC motor.

Crocker-Wheeler manufactured the 500 hp, 500 rpm motor for the slab squeezer. A 600 hp Westinghouse 125/408 rpm DC reversing motor turned the vertical edger.

Adjacent to the edger motor was the 7000 hp 42/80 rpm Westinghouse DC reversing motor for the roughing mill. This motor produces 2.5 million ft. lbs. at 36 rpm. The four motors for the finishing stands were manufactured by Allis Chalmers and were 5000 hp, DC units. The first three operated at speeds of 110/250 rpm, and the fourth stand operated at 125/265 because of the increase in speed due to elongation of the plates. DC current is supplied by the following motor-generator sets: 1) two Westinghouse 3000 kw generators turned by 6000 hp Westinghouse 370 rpm AC motor, with flywheel; 2) 2100 hp, GE synchronous motor turned a 1500 kw GE DC generator at 500 rpm; 3) two Allis Chalmers 8500 hp AC motors powered two 3000 kw DC generators at 375 rpm. All of the gear reducers were manufactured by United Engineering. The motor room also contained extensive control panels, exciter sets, and two rotary air compressors. The basement, where ventilation equipment was installed, was flooded at the time of this survey.

<u>Source</u>:

"New Highs in Efficiency Seen in New 100-inch Semi-Continuous Sheared Plate Mill," <u>United Effort</u> 17(2): 3-18.

<u>Historic Name</u>: U.S. Steel, Homestead Works, 100" Plate Mill Shear and Shipping Buildings
<u>Present Name</u>: Park Corporation, Homestead Works, Shear Building
<u>Location</u>: West Homestead, Allegheny County, PA
<u>Construction</u>: 1917, 1936
<u>Documentation</u>: Photographs of the 100" Plate Mill can be found in HAER No. PA-200-D.

DESCRIPTION

A total of six buildings were needed to shear, heat treat and ship the 100" plate mill's production. After exiting the last finishing stand, the plate entered the Runout Building to be leveled. After levelling, the plate traveled in one of three directions. It could be sheared in the No. 3 Shear Line, put on a car and transferred to the No. 4 Shear Building, or transferred by roll table to the rotary shear in 100" Plate Mill Shear Building. The rotary shear line also fed normalizing and quench facilities in the 100" mill shipping building. A transfer car connects the 100" Shear and Shipping Buildings to the No. 1 and No. 2 Shear Building and the former 110" Mill Shipping Building. Each of these buildings has a rail spur. Except where noted the buildings all have steel frames with riveted trusses, and are about 54' high. Overhead cranes range in capacity between 10 and 100 tons.

The Runout Building measures 564' (including a 495' addition added in 1944) x 90' with fan-type Fink trusses supporting a monitor roof. It contained a leveler with pinch entry rolls and 8 over 9 - 8" diameter x 108" wide bending rolls manufactured by Birdsboro of Birdsboro, Pennsylvania, and a heavier roll leveler with pinch entry rolls and 12" diameter x 108" wide bending rolls arranged six over five manufactured by Lewis Foundry, Pittsburgh. Two end shears manufactured by Cincinnati and arranged in parallel lines to compose the No. 3 shear line. The mill's high volume required that the No. 3 shear line cut plate up to 3/8" thick in multiple lengths. After end shearing, these plates were sent via transfer car or magnetic unpiler to shear building No. 4 for edge trimming and cutting to final length.

The No. 4 Shear Building, measuring 678' x 125', has compound fan trusses and movable panels on the main exterior wall. A Mesta rotary edge shear was installed in 1982 (brought to Homestead from the Fairfield Works). It is followed by a McKay cold leveller with two 12" in diameter and 108" wide pinch entry rolls and nine 8" in diameter, 108" long bending rolls, with back-up rolls arranged four over five. A Cincinnati end shear cut the plates to length. The building also contained a scale, and one of two 144" squaring shears. Plate too thick for the No. 3 and No. 4 Shear Lines was sent to a 3/4" x 100" shear located on the runout building which removed the crops. From there the thicker plate was sent to the 100" Mill Shear Building.

The 100" Plate Mill Shear Building has Pratt roof-trusses supporting a monitor roof, and measures 1696' (including 416' added in 1944) x 45'. It is 47' high. Plates 3/16" - 3/4" thick and 24" - 96" wide were sent to a United Engineering double-rotary side shear. Two end shears, one located in the Shear Building and the other in the adjacent Shipping Building, cut the plates to a maximum length of 1320". The plates were then either loaded onto rail cars or stored in the Shipping Building. Originally, the end shears used curved knives that cut the plate with a rocking motion. Designed and built at Homestead, the end shears were converted in the 1950s to conventional guillotine blades to reduce shear bow and maintenance delays.

Beyond the end shear in the Shear Building stands a small test shear and coupon storage shelves. Plates that were too thick for the rotary shear were removed and sent to No. 1 and No. 2 Shear Units by transfer car. Also in the Shear Building were water pumps for the mill stands. Each of three 900 hp

Westinghouse motors powered two 800-1000 gpm pumps. A 2100 gpm pump recirculated cooling water to the continuous furnaces.

The 1540' x 90' Shipping Building has fan-type Fink trusses with a monitor and a sawtooth roof that faces the river. In addition to plate storage, and the end shear described above, the shipping building contains a Drever continuous furnace. Initially designed for normalizing, the five zone, 130' long x 9' wide natural gas burning furnace was modified to a hardening furnace. A water quench and McKay leveler, similar to the one in the No. 4 Shear Building, were used in quench and temper operations.

The Nos. 1 and 2 Shear Units are located in the former shear and shipping bays of the 110" plate mill and date to 1917. The 110" Mill Shear Building is 938' x 80' and the 110" mill Shipping Building is 1140' x 80' (416' of which is a 1944 addition). Both buildings have Warren trusses with two sawtooth gables facing opposite directions. Part of the Shipping Building is walled off with corrugated metal and is used for a roll shop (see entry under Auxiliary Structures). The shear units themselves consist of one 110" end shear and one of two 140" side shears manufactured by Morgan Engineering grouped around an "L" shaped bed of castors located in both the [110" Mill] Shear and the Shipping Buildings. A circle shear manufactured by R.S. Newbold & Sons Co., Norristown, Pa, a rotary scrap shear made by Thomas Spacinne Machine, Pittsburgh, Pa, and a United Engineering end shear are also nearby.

HISTORY

The complicated product flow is a result of the 100" mill's high production volume and a series of World War II expansions. The initial configuration was the series of zig-zags which leads to the two end shears in the 100" mill shipping building. The 110" "Liberty" mill was shut down in 1937, and its shearing equipment was modified for the 100" mill. The No. 3 and No. 4 Shear Lines were added in 1941 to handle the higher volume the mill produces when it rolls thin plate. Until the installation of the rotary side shear from the Fairfield Works in Alabama, No. 4 shear used side shears and a castor bed much like that which survived from the 110" mill.

Sources:
"Announce $60,000,000 Expansion at $10,000,000-Mill Dedication." Steel 100 (January 18, 1937): 19.

Fenstermaker, Lloyd. Superintendent of the 100" Mill. Interviewed by author, May 14, 1990, and November 5, 1990.

Making (1940), 736-743; and (1951), 766-769, 1237.

The 160" Plate Mill is located on both sides of the Homestead High Level Bridge, 1500' west of the Amity Street Gate. Buildings are oriented on a northeast-southwest axis while the slab yards run northwest-southeast. Additional facilities are located near the 48" Universal Plate Mill on the former site of open hearth No. 2.

The 160" Mill complex rolled, sheared, heat treated, and shipped plate from slabs produced in the 45" universal slabbing mill. The slabs are conditioned in the slab yards before heating to rolling temperature. The heated slabs were descaled by a scalebreaker and rolled in the 160" mill. Water sprays cooled the plates before they were flattened by the leveller. In the shear building, thinner plates were marked, sheared, and weighed before storage in the Shipping Building. The plate treating building houses continuous heat treating furnaces for volume production of thinner gauge alloy plates. Thicker plates were transferred to the Flame Cutting Building where they were cut and cooled. Any necessary heat treatment for plates over 2" was done in the forge department. Stainless and homogeneous armor plate was inspected, precision sheared, conditioned, cleaned and stored in the stainless facilities. (Also, see entries on auxiliary facilities including Slab and Plate Mill Office, and 45" and 160" Mill Roll Shop.)

The 160" Plate Mill complex was constructed by the Defense Plant Corporation on the former site of the Howard Axle Works and the residential area west of the City Farm Lane boundary of the works. It was laid out along the axis of the 100" Semi-Continuous Plate mill. The 160" Mill was designed to roll armor and ship plate for the Navy. Operational in early 1944, the 160" Mill was the last link in the Defense Plant Corporation's Homestead expansion. A second turn was added by September 1944 despite technical difficulties in the shear department. Wartime research into alloy steels rolled for the Navy on the 160" Mill had commercial application after the war. The commercial success of these high-strength, low-weight steels required several expansions to the mill. The mill shut down in 1985, in part, because of a decline in regional steel fabricators.

<u>Sources</u>:

Fenstermaker, Lloyd. Superintendent of the 100" Mill. Interviewed by author, May 14, 1990.

"Homestead Mill Adds Turn." Iron Age 154 (September 14, 1944): 126.

Hornak, Raymond. Superintendent of the Homestead Structural Mill 1978-1983. Interviewed by author, March 12, 1990.

"New Defense Plant Nears Completion." Steel 114 (January 24, 1944): 31.

Plancor.

Historic Name: U.S. Steel, Homestead Works, 160" Plate Mill Slab Yard
Present Name: Park Corporation, Homestead Works, 160" Plate Mill Slab Yard
Location: West Homestead, Allegheny County, PA
Construction: ca. 1942
Documentation: Photographs of the 160" Plate Mill can be found in HAER No. PA-200-F. Drawings of the 160" Plate Mill can be found in HAER No. PA-301.

DESCRIPTION

This 75' high steel-frame building measures 588' (including an 120' addition) x 108'. Roof and gable ends are covered with corrugated siding with four fiberglass panels in the roof approximately opposite the 160" mill continuous furnaces. An open sided monitor rises above a riveted unidentified truss with knees. Hi-strength bolts were used in the extension. The floors are dirt and slag. Slabs were assembled in rolling sequence in this bay and then sent to the furnaces.

HISTORY

The building once contained annealing hoods to slow-cool slabs for thick plate. Furthermore, some steels needed to be preheated even before being sent to the heating furnaces. Both slow cooling pits and annealing hoods were used for this depending on slab thickness. The 160" Plate Mill Slab Yard was extended 120' in 1960 to store slabs for thin gauge plate used in railroad cars.

Sources:

Hornak, Raymond. Superintendent of the Homestead Structural Mill 1978-1983. Interviewed by author, March 12, 1990.

Plancor.

Historic Name: U.S. Steel, Homestead Works, 160" Plate Mill Batch Furnace Building
Present Name: Park Corporation, Homestead Works, 160" Plate Mill Batch Furnace Building
Location: West Homestead, Allegheny County, PA
Construction: ca. 1942
Documentation: Photographs of the 160" Plate Mill can be found in HAER No. PA-200-F. Drawings of the 160" Plate Mill can be found in HAER No. PA-301.

DESCRIPTION

The Batch Furnace Building is about 50' high and measures 118' x 110'. Two side bays are all under one gable. The siding is corrugated metal. Vertical members rising from the bottom chord support a corrugated metal roof with a continuous ventilator. The building has a dirt floor. Four batch furnaces are divided into two zones by a pier in the middle of their length and have a hearth size of 12' x 46'. Two banks of burners face each other on the narrow ends. Two burn a mixture of coke-oven and natural gases, while the remaining two were converted to "oxy-fuel" burners in 1984. Originally each furnace heated 15 tons of slabs from cold to 2250°F per hour, that were 12-20½" thick and up to 144" long. A charging crane moves slabs from a transfer car to the furnaces and from the furnaces to the 160" mill approach table.

HISTORY

The Batch Furnace Building was built by the Defense Corporation. The reasons for converting two furnaces to "oxy-fuel" is unclear, although a former superintendent indicated that it was probably for carbon steel plate production. The ceramic recuperators were abandoned as part of the conversion.

Sources:

Hornak, Raymond. Superintendent of the Homestead Structural Mill 1978-1983. Interviewed by author, January 4, 1990.

Making (1951), 755.

Plancor.

U.S. Steel Drawing: HO-PL-11037 (1984).

Historic Name: U.S. Steel, Homestead Works, 160" Plate Mill Recirculating Pump House
Present Name: Park Corporation, Homestead Works, 160" Plate Mill

Recirculating Pump House

Location: West Homestead, Allegheny County, PA
Construction: 1942
Documentation: Photographs of the 160" Plate Mill can be found in HAER No. PA-200-F. Drawings of the 160" Plate Mill can be found in HAER No. PA-301.

DESCRIPTION

This 45' high steel-frame building measures 100' x 70', and has riveted Fink trusses, a closed monitor, corrugated siding, and a concrete floor. A 9-ton overhead crane runs the length of the building and services a scale pit and a rail line that run parallel to the northwest wall. Equipment includes a 20' diameter make-up water tank, two General Electric 300 hp motors powering four 3000 gpm centripetal water pumps, and two strainers. The pumps provided high pressure descaling water for the 160" mill and the scalebreaker.

HISTORY

Originally the recirculation pumps were configured with three motors powering two pumps each with three Brassert Strainers. The 160" Plate Mill Recirculating Pump House was built by the Defense Plant Corporation.

Sources:

Hornak, Raymond. Superintendent of the Homestead Structural Mill 1978-1983. Interviewed by author, March 12, 1990.

Plancor.

U.S. Steel Drawing: HO-PL-15 (1942).

Historic Name: U.S. Steel, Homestead Works, 160" Plate Mill Motor Room
Present Name: Park Corporation, Homestead Works, 160" Plate Mill Motor Room
Location: Homestead and West Homestead, Allegheny County, PA
Construction: 1942
Documentation: Photographs of the 160" Plate Mill can be found in HAER No. PA-200-F. Drawings of the 160" Plate Mill can be found in HAER No. PA-301.

DESCRIPTION

The 160" Mill Motor Room measures 312' x 85'. This 50' high one-story building (with basement) consists of an exposed steel frame with cinder block infill. A shallow half-gable Warren truss, with only half of its vertical members, supports the gravel and tar roof. The floors and foundations are concrete. Air lock doors connect the Motor Room to the Mill Building. The equipment includes:

I. Scalebreaker: 1600 hp, 375 rpm, AC motor; double reduction drive with two 8' diameter flywheels and its own slip regulator.

II. Mill Motors: Two Westinghouse 5000 hp, single armature, DC motors ran at 40/80 rpm and produced 1.8 million ft. lbs. of torque each. The top work roll motor is raised and set back from the motor for the bottom work roll. A jack shaft, bracket and bearing, connects the top roll motor to the top work roll spindle.

III. Flywheel Motor Generator Set: 9,000 hp, 25 cycle AC motor connected to three 3,000 kw DC generators and a flywheel 15' in diameter.

IV. Slip regulator: Vertical electrodes raised or lowered in a saline solution increased or decreased AC current sent to the 9,000-hp motor.

V. Exciter Set No. 1: A 150 hp AC motor turned a 20 kw master exciter, a 100/300 kw mill motor C.P. exciter and 5/3.75 kw upper and lower mill motor pilot exciters.

VI. Exciter Set No. 2: A 150 hp AC motor turned 11 kw upper and lower mill motor variable potential exciters, a 44 kw dynamic braking exciter, and a 60 kw general field exciter.

VII. Variable Voltage Motor Generator Sets No. 1 and No. 2: These sets were turned by 800 hp AC motors. Two 150 kw generators powered the screwdowns, two 200 kw generators powered the approach and delivery tables, and three 150 kw run out table generators.

VIII. 1500 kw solid state rectifier: Installed before 1984, and an original 1500 kw motor generator set powered by a 2100 hp AC motor supply DC current to auxiliary equipment.

IX. Transformers: Three 1500 kva transformers located outside the Motor Room.

X. Ward-Leonard Controls: Extensive electrical panels, wiring, and switches used to control the speed, horsepower and torque of the main mill motors.

XI. Ventilation equipment: Twelve blowers circulated air to cool the equipment. Two ducts conveyed fresh air to the basement via the make-up rooms where the air was cleaned by two precipitators. Blowers drew the motor room air through the motor and generator bases and passed it through water coolers.

HISTORY

The 160" mill was the first application of the twin electric drive, developed in 1928 for blooming and slabbing mills at the South Chicago Works, to a plate mill in the United States. With the exception of the solid state rectifier, the Motor Room has changed little since its construction by the Defense Plant Corporation.

Sources:
Cramer, Frank W. "Twin-Motor Drives in Hot Reducing Mills." Iron Age 156 (October 11, 1945): 58-61.

Making (1951), 674-676.

McBride, David. General Foreman Electric Department, Homestead Works, 1981-1984. Interviewed by author, January 29, 1990.

Plancor.

U.S. Steel Drawings: HO-PL-1204 (1942), HO-S-2892 (1942), HO-S-2710 (1942).

Historic Name: U.S. Steel, Homestead Works, 160" Plate Mill Building
Present Name: Park Corporation, Homestead Works, 160" Plate Mill Building
Location: Homestead and West Homestead, Allegheny County, PA
Construction: ca. 1942
Documentation: Photographs of the 160" Plate Mill can be found in HAER No. PA-200-F. Drawings of the 160" Plate Mill can be found in HAER No. PA-301.

DESCRIPTION

This 75' high steel-frame building measures 936' x 100'. The walls are corrugated metal with a strip of fiberglass panels with hinged sash at chest level along exterior walls. A cinder block wall separates the Mill Building from the Motor Room. Fan-type Fink trusses support a roof with continuous ventilators. Warren trussing is used where the building passes under the

Homestead High Level Bridge. The roof is corrugated cement asbestos downstream from the High Level Bridge and corrugated metal on the upstream section. A rectangular vent above the flash heating furnace projects above the slope of the roof to a level equal to the bottom of the continuous ventilator. The building has a concrete floor with occasional brick sections. The equipment includes:

I. Scale-Free Slab Furnace: Manufactured by Selas Corp., the furnace heated individual slabs up to 11'-8" long, resting on edge. Eight natural gas burners with a high fuel to air ratio heated each side of the slab. The chamber door was designed to create an air tight seal. A portion of the furnace chamber air was tapped to pre-heat the combustion air. Flues rise from each corner and vent just below two hoods which exhaust the gases through the roof. The 20-36 hours required to bring a slab to rolling temperature limited the furnace's value.

II. Continuous Slab Reheating Furnaces: See inventory entry for Flame Cutting Building.

III. Mesta Scale Breaker: The two-high, closed frame stand uses 36" in diameter x 70" long alloy-steel fluted rolls. The top roll is held against screw down mechanisms by hydraulic jacks. Two 50 hp motors power the screwdowns. Water and water-soluble oil lubricate phenolic resin bearings. A 1600 hp, 375 rpm motor with double reduction flywheel gear drive is connected to the rolls via pinions and universal spindles. Top and bottom 1500 psi water sprays are on the delivery side.

IV. 160" Mesta Plate Mill: A four-high reversing mill with closed frame. The alloy-iron work roll bodies are 36" in diameter (with a maximum crown of 0.024") x 160" long. The alloy-steel back-up rolls are 59" diameter x 154" long and are supported by oil film bearings and tapered thrust bearings. Two 150 hp motors with programmable electric controls screw down the rolls. Hydraulic jacks, or balance cylinders, mounted on top on the housing pull the upper rolls against the screws. Two Westinghouse 5,000 hp D.C. 0-40-80 rpm reversing motors in the adjacent 160" Plate Mill Motor Room are connected by 36' universal spindles supported by hydraulic cylinders. In 1945, the mill's capacity was estimated at 600,000 net tons of plate per year.

V. Flash Heating Furnace: Manufactured by Amsler Morton Co., the facility consists of a refractory lined furnace and a steel framework that supports two sets of pick up arms (maximum load 60,000 lb). The arms working individually or in concert, move slabs or plates between the roll table and the furnace. The furnace has a hearth size of about 29' x 15½' and can accommodate slabs up to 13'-4" wide and 1'-3" thick. Installed to reheat stainless plate that cooled below rolling temperature, the furnace was of limited value because of its limited hearth size.

VI. Mesta Leveller: Equipped with two hydraulic pinch entry rolls, this leveler is 16" in diameter x 160" long. Eleven 13" diameter x 160" long bending rolls are arranged six over five. The unit levels plate up to 1½" thick. The rolls open 6" to allow thicker plates to pass through.

HISTORY

The plate rolling process has undergone little change since the mill was operational in 1944. The four-high mill concept was first extensively developed and employed in the 1920s for continuous strip mills. Notable exceptions were the Homestead's 32" universal mill (converted to a four-high mill in 1891), and the 206" four-high plate mill built for Lukens Steel in 1917. Anti-friction bearings in the backup rolls and the lower inertia of the multi-armature reversing motors developed in the 1920s were necessary before the four-high plate mill was generally used. A few minor changes include the substitution of fiberglass panels for the original glazed windows and the removal of a turntable, located after the Scalebreaker, that turned slabs for broadside passes. Once operators became more skilled, they reversed alternate rolls on the mill tables to turn the slabs. Both changes happened at unknown dates.

Sources:
Beard, Geoffrey G. United Engineering and Foundry Company. New York: Newcomen Society in North America, 1961.

Cramer, Frank W. "Twin-Motor Drives in Hot Reducing Mills." Iron Age 156 (October 11, 1945): 58-61.

Hornak, Raymond. Superintendent of the Homestead Structural Mill 1978-1983. Interviewed by author, January 4, 1990.

"New Furnace Heats Slabs without Scale Formation." Iron and Steel Engineer 44 (June 1967): 171-72.

Plancor.

U.S. Steel Drawings: HO-PL-8061 (1965), HO-PL-8050 (1965), HO-PL-8051 (1965), HO-PL-8054 (1966), HO-PL-8055 (1965).

Historic Name: U.S. Steel, Homestead Works, 160" Plate Mill Complex, Shear Building
Present Name: Park Corporation, Homestead Works, 160" Plate Mill Shear Building
Location: Homestead, Allegheny County, PA
Construction: ca. 1942
Documentation: Photographs of the 160" Plate Mill can be found in HAER No. PA-200-F. Drawings of the 160" Plate Mill can be found in HAER No. PA-301.

DESCRIPTION

This 75' high, 989' x 115' building with steel frame and sheet-metal siding has corrugated cement asbestos roofing and monitors. A row of glazed windows are in the clerestory of the northwest side, while a row of fiberglass panels with horizontally pivoting sashes are at chest level. The monitors have fixed side louvers which are almost entirely covered with corrugated sheeting. The knee braced roof trusses are fan-type Finks. The floors are concrete. The production line is arranged in a "U" that flows from the transfer tables in the west corner along the northwest wall to the crop shear, and then to a transfer bed which sends the plates back along the southeast wall in the direction they came. The side and end shears are located on this last section of the "U". A standard gage rail siding serviced a flame cutting area in the northeast end of the building. Major machinery includes:

I. Mesta plate marker: An operator ridden and controlled rail vehicle powered by an electric rail below the floor. The plate marker runs parallel to the crop-shear approach table.

II. Mesta crop and end shears: Two identical shears, located before and after the side shears, serve as crop and end shears respectively. The 160" wide oil-hydraulic guillotine shear is powered by a 200 hp electric motor and reciprocating pump developing 7-9,000 psi on top of the shear. Air pressure (originally hydraulic) gags, or clamps, hold the plate steady for the knife. Springs lifted the blade back into position. A guillotine shear, with two scrap buckets sunk into the floor, cuts the scrap. The end shear is equipped with two gages used to cut the plate in 60-720" lengths.

III. Side shears: Two side shears, each on opposite sides of the roller table, are identical to the crop shear except the blades are 180" long and placed parallel to the length of the plates. A series of 13 electromagnets located in the roll tables positioned the plates for shearing. The second side shear is equipped with a width-gage guide.

HISTORY

The Shear Building has not changed in any substantial way except for the replacement of the windows and the removal of the flame cutting equipment.

<u>Sources</u>:
<u>Making</u> (1951), 760.

<u>Plancor</u>.

U.S. Steel Drawing: HO-PL-1662 (1943, rev. 1954), HO-PL-1662 (1944).

<u>Historic Name</u>: U.S. Steel, Homestead Works, 160" Plate Mill Complex, Shipping Building
<u>Present Name</u>: Park Corporation, Homestead Works, 160" Plate Mill Shipping Building
<u>Location</u>: Homestead, Allegheny County, PA
<u>Construction</u>: ca. 1942
<u>Documentation</u>: Photographs of the 160" Plate Mill can be found in HAER No. PA-200-F. Drawings of the 160" Plate Mill can be found in HAER No. PA-301.

DESCRIPTION

The 1500' long (including two additions totaling about 340') x 100' wide x 75' high building has corrugated metal cladding over a steel frame. The original building has a corrugated cement asbestos roof and a fixed louver monitor largely covered with corrugated metal. The additions are roofed with corrugated sheet metal and a continuous ventilator. The floors are concrete. A standard gauge rail line runs the entire length of the southeast side below the building floor. Transfer cars at either end of the building travel between the 160" Plate Mill Building and the flame cutting section of the Shear Building respectively. A gravity conveyor table receives the plates from the magnetic transfer cranes that connect the Shear Building with the Shipping Building.

HISTORY

When originally constructed by the Defense Plant Corporation, the Shipping Building had a lean-to on the southeast side. Used to prepare rail shipments, the lean-to was demolished to make way for the Plate Treating Building in 1957. Likewise, the 1957 and 1959 extensions, added to store plates from the flame cutting section of the Shear Building and the Plate Treating Building, replaced beam yards constructed to condition slabs rolled on the 30" slabbing mill.

Sources:
Hornak, Raymond. Superintendent of the Homestead Structural Mill 1978-1983. Interviewed by author, March 12, 1990.

Making (1951), 761.

Plancor.

U.S. Steel Drawings: HO-G-1063 (1944), HO-G-1063 (1944), HO-PL-4974 (1957), HO-PL-5904 (1959).

Historic Name: U.S. Steel, Homestead Works, Green Inspection Building
Present Name: Park Corporation, Homestead Works, Green Inspection Building
Location: Homestead and West Homestead, Allegheny County, PA
Construction: 1955
Documentation: There are no photographs of the Green Inspection Building.

DESCRIPTION

The Green Inspection Building is a 600' x 80' steel frame building about 70' high. Fink trusses and hi-strength steel bolts support the corrugated metal roof and its continuous ventilator. The concrete floored building was last used for parts storage. A transfer car connecting the 160" Mill to the 45"/160" Roll Shop passed through the building.

HISTORY

The Green Inspection Building was constructed between the Flame Cutting Building and the 45"/160" Roll Shop Building in 1955. Constructed in conjunction with the Plate Treatment Line, the Green Inspection Building once contained plate inspection beds. Its inspection function was superseded by the construction of the Stainless Facilities in 1969.

Source:
Hornak, Raymond. Superintendent of the Homestead Structural Mill 1978-1983. Interviewed by author, March 12, 1990.

Historic Name: U.S. Steel, Homestead Works, Flame Cutting Building
Present Name: Park Corporation, Homestead Works, Flame Cutting Building
Location: Homestead and West Homestead, Allegheny County, PA
Construction: ca. 1942
Documentation: There are no photographs of the Flame Cutting Building.

DESCRIPTION

The roof of the southwestern section of this one-story steel-frame building is about 6' higher than the rest of the building. The truss is unidentified and supports a monitor roof. The monitor on the northeastern section of the roof has three ventilators. The building measures 600' x 118' and contains concrete floors. Equipment includes two continuous slab heating furnaces (shared with the 160" Mill Building), two flame cutting tables and a plate preheater. The continuous slab reheating furnaces are double-row and triple-fired with ceramic recuperators manufactured by Rust Engineering of Pittsburgh. Slabs travel through the furnaces from the Flame Cutting Building to the 160" Mill Building. The hearths are 80' x 23'. Each furnace heats approximately 70 tons of slabs 3"-12" thick, 44"-60" wide and 70"-120" long from cold to 2250 degrees F per hour. Two transfer cars pass through the Flame Cutting Building: one removes 1-1/2" or thicker plates from the 160" mill building and the other moves rolls from the 160" mill to and from the 45"/160" Roll Shop.

HISTORY

Except for the continuous furnaces, this building is largely empty. A 1951 description indicates that the Flame Cutting Building once contained pantograph sketch-cutting machines, large heat-treating ovens, and a heat treating pit. In 1962, the building contained four tracing/cutting tables, an oxygen cutting torch, inspection horses, a preheating furnace and cooling beds. Despite the changes in the arrangement and type of equipment, the Flame Cutting Building was used to cut plates too thick for the shears. Some steels required pre-heating before cutting.

Sources:

Hornak, Raymond. Superintendent of the Homestead Structural Mill 1978-1983. Interviewed by author, March 12, 1990.

Making (1951), 755, 761-762.

Plancor.

U.S. Steel Drawing: HO-PL-1100 (traced in 1962 from 1942 drawing).

Historic Name: U.S. Steel, Homestead Works, Plate Treating Building
Present Name: Park Corporation, Homestead Works, Plate Treating Building
Location: Homestead, Allegheny County, PA
Construction: 1957, 1958, 1960
Documentation: There are no photographs of the Plate Treating Building.

DESCRIPTION

The Plate Treating Building is about 1300' long (including both a 416' and 64' extension) x 120' wide x 75' high. A steel frame and compound fan trusses with a continuous monitor support a sheet metal roof. The floor is brick and concrete. The adjacent Classification and Shipping Building is 1300' x 60' with fan-type Fink trusses and ventilators. It is not as tall as the Treating building. The southeast wall of the Classification Building has sliding panels and the clerestory has fiberglass panels. The facility heat treats plates up to 13' wide, 45' long, and 2" thick. Plates are brought by tractor to the Classification and Shipping Building and sorted according to a treating schedule. A magnetic gantry crane transfers the sorted plates to the Treating Building and puts them on roller tables which feed one of three parallel continuous treating lines.

The No. 1 Heat Treating Line consists of a 135' six-zone hardening furnace manufactured by Drever, followed by a 58' high-pressure water quench and a 150' continuous tempering furnace (also Drever). The No. 2 line is similar except the hardening furnace has eleven zones. A third hardening furnace, 100' long, located between the No. 1 and No. 2 lines, is used strictly for stainless plate and was lengthened 50' in 1966 to accommodate longer plates. All furnaces are natural gas-fired, non-regenerative and continuous. Between the tempering furnaces is a roller table used in conjunction with two transfers cars to by-pass the tempering furnaces.

Extensive pump facilities, located in a two-level basement, provide quench and furnace roller cooling water. A leveling and shear line continues beyond the No. 1 Treating Line and is composed of a four over five McKay roller leveller with back-up rolls, a turntable about 50' long, a Mesta side shear (similar to those in the 160" Shear Building), a scrap shear, and a Mesta end shear that cuts plates up to 1" thick.

HISTORY

U.S. Steel installed the No. 1 Treating Line in 1957 for production of its quench and tempered T-1 high-yield strength steel. The quench and temper process produced increased yield strengths between one and one-and-a-half times over the added production costs and allowed fabricators to reduce metal usage. A spinoff of wartime armor plate research, the product line was very successful and required the construction of the No. 2 line in 1960. Homogenous armor and stainless plate were also heat treated. Construction of the classification building was necessary because the No. 2 line was installed in the area that had been previously used to sort the plates.

<u>Sources</u>:

"Another Step Forward for 'T-1' and Stainless Steels." <u>U.S. Steel News</u> 22 (October 1956): 23-25.

Hornak, Raymond. Superintendent of the Homestead Structural Mill 1978-1983. Interviewed by author, March 12, 1990.

<u>Making</u> (1964), 702-703.

"These Steels Have What the Users Want." <u>Steel</u> 142 (February 17, 1958): 126-130.

U.S. Steel Drawings: FM-100 Part II (1957, rev. 1980), HO-PL-6999 (1961), HO-PL-4888 (n.d., rev. 1963), HO-PL-4771 (1956, rev. 1964), HO-PL- 9853(1968).

<u>Historic Name</u>: U.S. Steel, Homestead Works, Slab Yards A, B, and C
<u>Present Name</u>: Park Corporation, Homestead Works, Slab Yards A, B, and C
<u>Location</u>: West Homestead, Allegheny County, PA
<u>Construction</u>: ca. 1942
<u>Documentation</u>: There are no photographs of the Slab Yards.

DESCRIPTION

Slab Yard C is a 400' extension off the 45" Mill Building with fan-type Fink trusses. Slab Yards A and B are perpendicular to Slab Yard C, and measure about 670' x 110'. Each is about 80' high. The buildings have steel frames with unidentified roof trusses, monitors, dirt and slag floors, and corrugated metal cladding. About 110' of yards A and B closest to the 45" mill building are without a roof to dissipate heat and steam from the hot slabs. Rail sidings serve each bay. Diesel powered transfer cars bisect yards A and B and connect them with the 160" mill. The slab yards contain the remains of several slow cooling pits.

After rolling, hot slabs were transferred to the slab yards. Defects generated by ingot casting and slabbing were removed by hand or scarfed with acetylene torches before they were rolled into the final product. Slow cooling pits were used to relieve stresses of certain alloys before and after scarfing. After conditioning the slabs were transferred to the 100" Mill or 160" Plate Mill Slab Yards where they were stacked according to the rolling schedule. Slab Yard C stored long slabs sent to the Irvin Works. Scarfing in Slab Yards B and C was done on the riverside of the transfer line and was directed by the respective plate mills.

HISTORY

All three slab yards were constructed during World War II. Yards B and C were built by the Defense Plant Corporation, while A yard was financed by U.S. Steel. They served the 45" mill until U.S. Steel closed it down about 1985.

<u>Sources</u>:

Ericson, A.G. "The Universal Slabbing Mill at Homestead." <u>Iron and Steel Engineer</u> 22 (March 1945): 35-46.

Hornak, Raymond. Superintendent of the Homestead Structural Mill, 1978-1983. Interviewed by author, March 12, 1990.

<u>Plancor</u>.

STEELSHAPING - STRUCTURAL MILL

Historic Name:	United States Steel, Homestead Works, Structural Mill
Present Name:	Park Corporation, Homestead Works, Structural Mill
Location:	Munhall, Allegheny County, PA
Construction:	1926, 1964
Documentation:	Photographs of the structural mill can be found in HAER No. PA-200-H.

NOTE: The Structural Mill was in the early stages of demolition when the inventory was made. As a result, the inventory lists only the remaining equipment that was safe to approach at the time of the field survey and does not provide a bay-by-bay description.

DESCRIPTION

The Structural Mill is a complex of buildings covering over twenty-six acres. The mill is laid out in a roughly triangular shape in order to fit into the space between the Penn Central and the P & LE tracks. The building contains two parallel production lines, the No. 1 standard structural line, and the No. 2 wide flange line. The numerous bays that contain these two production lines divide into four groups: soaking pits, blooming mills, finishing mills, and shear and shipping bays. Corrugated sheet-metal sheathed over a riveted steel-frame structure is used throughout the mill with the exception the brick walls of the motor rooms.

I. Soaking Pits: The soaking pits, which are used to bring ingots to a uniform temperature for rolling, are arranged in two parallel rows of fifteen pits each. The pits are equipped with recouperators and manufactured by Amsler Morton.

II. Blooming Mills: Only the motor rooms and the reheating furnaces for the No. 1 line remained intact at the time of the survey. The motor room is a single story structure with removable steel plate roof built within a larger steel-frame bay. A Westinghouse 7,000 hp, 50/120 rpm, DC reversing motor developing 2 million foot pounds of maximum torque powered the 44" blooming mill for the No. 1 structural line. The 54" blooming mill for the No. 2 line was powered by a Westinghouse 8,000 hp, 40/80 rpm, DC reversing motor developing a maximum torque of 2.4 million foot pounds and a maximum peak horse power of 14,400. Two partially scrapped flywheel-generator sets for the mill motors stand nearby. Blooms rolled on the 44" mill were reheated in four batch furnaces manufactured by Loftus. At least partially converted to fuel oil, the furnaces had several doors sealed with sprayed refractory material. The remains of three side-grip charging cranes are nearby.

III. Finishing Mills: At the time of the survey the only remains of the No. 1 structural line was the 28/32" finishing mill. Manufactured by Mackintosh-Hemphill, the mill consists of a 28' diameter, 75-ton flywheel, with either a 28" or a 32" pinion stand, and three-high roll stands. The lifting tables are no longer extant. Spare stands located against the motor room wall are used to speed roll changes. An overhead crane moved the roll stands between the mill and the set-up area.

The finishing mills for the No. 2 line, largely intact at the time of survey, consist of independent 52" universal roughing, intermediate, and finishing stands. The roughing and intermediate stands are identical reversing mills with separately driven vertical and horizontal rolls equipped with automatic screwdown devices. The edging stand precedes the main rolls of the roughing group, but the sequence is reversed for the intermediate stand. The finishing stand is a single pass, non-reversing stand and does not work the flange edges. The rolls were cut such that the flanges were slightly flared until the finishing pass allowing the mill to roll parallel flanges.

The finishing mill motor room was almost entirely intact at the time of this survey. A 5,000 hp, Westinghouse DC reversing motor powered the 36" blooming mill for the No. 1 line. A 6,000 hp, Westinghouse 25 cycle AC motor powered the 28/32" finishing mill. The main rolls of the 52" roughing and intermediate stands were powered by 7,000 hp, Westinghouse DC reversing 50/80 rpm motors, while 2,000 hp, Westinghouse DC reversing motors operating at 57/123 rpm supplied the edging rolls. A 4,000 hp, 25 cycle AC motor powered the finishing stand. The separate motors for each set of rolls allowed precise synchronization of speeds and a reduction of roll slippage.

IV. Shipping Bays: After rolling, the beams are cooled, straightened, sheared, stored and shipped under fifteen bays (three of which are detached additions to the complex). The north-south layout of the bays is perpendicular to the general material flow through the buildings. Among other things, this required the omission of building columns, and the corresponding reinforcement of the structural steel to permit the installation of equipment such as multi-bay cooling beds and beam shears. Remaining equipment for mill No. 1 includes a Mesta variable pitch rotary straightener with a turn around roll changing rig, a gag press to straighten the flanges of heavier beams, and a shear/piling system. The later consists of two shears with length gauges. Magnetic cranes load the beams onto electric transfer trucks which move them into the adjacent bay for storage.

Beams from mill No. 2 are cut to length by one of several hot saws before being sent to straighteners or gag presses. Continental manufactured a fixed pitch beam straightener, while the other, manufactured by Birdsboro, has manual adjustment wheels. Of special note are several 20-ton, "whirly-bird" overhead cranes in several bays. These cranes have rotating arms suspended from their trolleys. Each end of the rotating arm has an independent 10-ton hoist. This arrangement was necessary because the cramped site required that beam storage be perpendicular to the rail shipping lines.

In 1977 the total capacity of the structural mills was 1,249,000 net tons. The No. 1 line could roll standard beams up to 24", while the No. 2 rolled wide-flange beams as large as 36".

HISTORY

The Structural Mill is technologically important as an early example of the extensive use of electricity in a structural mill. The massive 54" blooming mill was also the first to roll wide-flange beams with parallel flanges.

The history of structural steel at Homestead is almost as long as that of the works itself. Andrew Kloman planned to produce his patented structural eyebars in the mill he built next to the Pittsburgh Bessemer Steel Company. The precise details of Carnegie's transformation of the works from rail to structural steel are somewhat murky. In 1884, a year after Carnegie acquired the Homestead Works, <u>The Pocket Companion</u> included steel beams for the first time, though this steel was probably rolled at the Union Mills. By 1886, 50,000 tons, about one third of Homestead's production, was non-rail products, most of which was probably structural steel. Between 1886 and 1892 two structural finishing mills, the 33" and the 35" mills, supplied by 33" and 40" blooming mills respectively, were added. In 1890 Homestead's annual capacity for structural steel was an estimated 75,000 tons

— nearly twice its capacity for plates. Iron Age described the engine that powered the 35" mill as "the largest horizontal engine fitted with Corliss liberating gear yet built in the country, if not the world."

Pittsburgh's advantageous location between eastern and midwestern markets, the relative slowness of the competition to enter the structural steel market, and Carnegie's expansion of the mill's production capacity made Homestead the dominant producer of structural steel in the nineteenth century. In 1897, Carnegie controlled 49.37 percent of the structural steel pool. The era's tremendous demand for structural steel was driven by the development of the steel truss bridge and the steel framed skyscraper.

Homestead's dominance in the industry began to change in 1901 with the formation of U.S. Steel. As part of its initial efforts to rationalize markets, U.S. Steel constructed a structural mill at the South Chicago Works to save shipping costs from Pittsburgh. The decline of Homestead's relative importance in the trade was furthered with Bethlehem Steel's successful introduction of the wide-flange beam rolled on the Grey, or universal beam mill. U.S. Steel had turned down an opportunity to acquire the Grey patent in the early 1900s and Bethlehem's exclusive ability to roll wide-flange shapes made it the only single-source supplier for all types of structural steel. Efforts to counteract this trend began in the 1920s. In 1924, after a successful multi-year experiment substituting a 4,000 hp synchronous motor for the 33" finishing mill's steam engine, U.S. Steel announced a $20 million modernization plan for Homestead's structural department. Building on the successful results of the tests, the new installation was completely electric powered and required extensive additions to the electric generation capacity at the Carrie Furnaces. The entire output of Homestead's existing structural mills was consolidated into a single mill, the No. 1 structural. A second mill, the No. 2 structural, was built to roll "Carnegie" beams — U.S. Steel's version of Bethlehem's wide-flange beams. Additional land for the expansion was unavailable, forcing mill engineers to squeeze this increased capacity into an already cramped space. That this was accomplished while maintaining production levels was a remarkable feat of engineering *legerdemain*.

The No. 1 line consisted of a 44" blooming mill (manufactured by United Engineering), a 36" bloomer (by Mesta), and a 28/32" finishing mill. The 36" mill served as a roughing mill to "breakdown" the reheated blooms into rough shapes before they were sent to the finishing mill. The finishing mill is called a 28/32" mill because is was designed to use either a 28" or a 32" pinion stand. Although rarely used, the smaller pinion stand permitted the mill to roll all but the largest standard beams.

The No. 2 line consisted of a 54" blooming mill and the three 52" mills described above. Like the 36" bloomer, the 54" mill broke ingots down to the rough shape of the beam being rolled on the finishing mills. Limitations of the equipment required that ingots for the largest beams be cast in beam shaped molds in order to insure proper reduction. (In addition to supplying the 52" universal beam mill, the 54" blooming mill rolled rounds for wheel blanks which were diverted to an adjacent bay and cut on special equipment.) Built by United Engineering, the 54" mill was the largest size blooming mill ever made and Homestead's was one of only two such blooming mills. The 8,000 hp motor that powered the 54" mill was described in 1927 by the then Electrical Superintendent of the Homestead Works as "the largest reversing motor in the world." A second more advanced 54" bloomer was installed at the South Chicago Works, but it had a twin-motor drive with two 5,000 hp motors that dispensed with the massive pinion stand used at Homestead.

The No. 2 structural, or Carnegie Beam mill, was the focus of a dispute between U.S. Steel and Bethlehem Steel over the Grey beam patent. Bethlehem claimed it violated the Grey patent, while U.S. Steel claimed, among other things, that the Grey patent was invalid because it did not represent anything new. The dispute was resolved out of court in 1929 with U.S. Steel agreeing to pay royalties.

By the 1950s, however, the technology of the Structural Mill became obsolete. At the time, for instance, the babbitt bearings of the 28/32" mill were lubricated with animal suet. A few changes were made: new soaking pits were installed in the 1950s, three storage bays were built in 1964 on the former site of Open Hearth No. 1, and the process of converting the AC motors to 60 cycle was begun. A new bloom shear for the 54" mill was installed, as were the Mesta and Continental beam straighteners, but retired employees do not speak well of them. The Structural Mill was the last mill to operate at Homestead. Shut down in 1985, the No. 2 structural was reopened briefly in 1986.

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Directory, (1890), 118; (1926), 92; (1930), 86.

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STEELSHAPING - SHOPS

Historic Name: U.S. Steel, Homestead Works, Press Shop No. 1
Present Name: Park Corporation, Homestead Works, Press Shop No. 1
Location: Munhall, Allegheny County, PA
Construction: 1891, 1893, 1903
Documentation: Photographs of Press Shop No. 1 can be found in HAER No. PA-200-K.

DESCRIPTION

Press Shop No. 1 is 80' high, with an outside diameter of 650' x 150'. It is a steel-frame building with a main aisle flanked by side aisles. Pin-connected Fink trusses support the corrugated metal roof except for the 180' furthest east, which are riveted Fink trusses.

The eastern section houses the No. 1 forging press manufactured by Bethlehem Steel in 1903. The maximum daylight of the press is 15'-9" with a maximum stroke of 9'-6" and the width between the columns is 15'-9". Two 55-3/4" diameter forging rams are powered by two electric, 3,600 psi, 296 gpm, reciprocating water pumps arranged in parallel. Four compressed-air accumulator bottles store hydraulic pressure for the forging cylinders. An electric reciprocating air-compressor with flywheel provides 3,600 psi for the bottles. Two weight-loaded accumulators, with 18" and 15" diameter cylinders, supply two 15" diameter balance cylinders. These accumulators also supply hydraulic pressure to an overhead crane, and to the manipulator tables on either side of the press. The electric pumps for the weight-loaded accumulators were not extant at the time of the survey. The two overhead cranes which handle the forging for the press have bridges manufactured by Bethlehem Steel in 1903. While one trolley has been electrified, the other retains its original hydraulic lifting system.

Also located in the eastern section of the Press Shop is a steam powered pumping engine manufactured by Bethlehem Steel. Originally connected directly to the press, the engine has two vertical 56" bore x 48" stroke cylinders, piston valves, joy-valve linkage, and a two piece 14' flywheel. A series of gears and cranks power a total of eight 5½" bore x 48" stroke reciprocating water pumps. A notation on a Bethlehem Steel shop photograph in the collection of the Hugh Moore Museum states that the engine was rated at 7,000 hp. Copies of blueprints for this engine are included in the field notes.

In the western end of the Press Shop is a 1,200 ton press manufactured by United Engineering under license from Davy. The press is powered by a steam intensifier, but the press was otherwise unavailable for close inspection.

HISTORY

Homestead's long association with military production began in 1888 with the construction of a mill to roll heavy armor plate. In late 1890 the company contracted with the Navy to produce armor plate. Shortly thereafter Carnegie, Phipps & Co. began construction of the Armor Plate Division downstream of what is now the Pittsburgh and Lake Erie Railroad. A 2,000-ton press manufactured by Davy Brothers of Sheffield, England, was installed about 1891. Despite its limited size in comparison to subsequent presses built at Homestead, the 2,000 ton press was probably able to forge plate up to 5" thick from ingots up to 4' in diameter.

By 1893 Carnegie expanded the shop, installing a massive press manufactured by Joseph Withworth & Co., Manchester, England. This press had a capacity of between 10,000 and 12,500 tons. One year later, Carnegie's face-hardened, reinforced, nickel-steel armor gained international recognition when it successfully competed with foreign producers for a Russian naval contract. Profit margins on armor helped Carnegie Steel earn $4 million in 1894, despite a severe nationwide depression.

In 1903 armor producers doubled capacity to supply President Roosevelt's "Great White Fleet". Having acquired Carnegie Steel, United States Steel purchased for its Homestead Works a 12,000-ton forging plant from Bethlehem Steel. The design of this plant descended from those of John Fritz and Russell Davenport of the Bethlehem Iron Co. in the 1880s. The new press replaced the original Davy press. Adjacent to the new press, the steam-powered pumping engine was nearly identical to the 1893 Withworth engine. The original forge building was disassembled and reerected as an addition to the adjacent Harvey Shop.

Rebuilt by Mesta Machine in 1944, the press forged armor plate until the early 1950s. During its last years of operation it was used solely to straighten plates. The adjacent pumping engine was repaired in the early 1970s shortly before being replaced by smaller electric pumps.

In 1934 the Whitworth press was scrapped and replaced with a 3,000-ton press that was installed and operated at the Gary, Indiana plant of American Bridge in 1919. The 1,200-ton press was installed two years later. The latter was built in 1916 and was purchased second hand from the New York Ship Building Co.

Demolition of the entire building was completed, in 1990. The Press No. 1 was not destroyed.

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U.S. Steel Drawing: Foreign Prints file FP-57, see also appendix to the measured drawings of the Press Shop No. 1 which accompany this inventory.

Historic Name: U.S. Steel, Homestead Works, Press Shop No. 2
Present Name: Park Corporation, Homestead Works, Press Shop No.2

Location: Homestead, Allegheny County, PA
Construction: 1941, ca. 1970
Documentation: Photographs of the Press Shop No. 2 can be found in HAER No. PA-200-L.

DESCRIPTION

Press Shop No. 2 is composed of heating, forging, and treating bays arranged in a closed "U"-shape with overall dimensions of 800' x 350'. The forge bay is about 100' tall and the heating and treating bays are about 85' tall. The steel frame building is covered with corrugated metal siding, and has dirt and slag floors. The forging bay has riveted fan-type Fink trusses with monitor and an additional ventilation strip projecting from one of the top cords. The heating and heat treating bays also have fan-type Fink trusses with monitors. Lean-tos beside the heating and treating bays have Warren trusses with 1/2 their vertical members. An 150' addition was built onto the heating and treating bay in the early 1970s. It followed the existing lines, but used welded connections and replaced the Warren trusses of the lean-tos with single structural beams.

Forging ingots, frequently cast in the electric furnace department of the Duquesne Works, were heated to forging temperature in any of ten furnaces with the following approximate overall dimensions: 20' x 30', 30' x 45', 30' x 50', and 30' x 60'. The furnaces burned coke-oven and natural gases. A 10,000-ton Mesta water-hydraulic press with two compressed-air accumulators and two pre-fillers forged the heated ingots. Two cylinders with 50" diameters exerted the downward pressure. The balance cylinders have an 18" diameter and are mounted on the press foundation. Four electric centrifugal pumps connected in series provided 4,800 psi water at 1200 gpm. The maximum daylight of the press is 19' 5-1/2" with a maximum stroke of 7'-9". The inside width between the columns is 16' 6". Forging is handled by a combination of two 300-ton overhead cranes and a motor driven Alliance 75-ton capacity manipulator. Numerous forging dies and mandrels are stored nearby.

The heat-treating aisle contains ten furnaces with the following approximate overall dimensions: 20' x 30', 20' x 40', 30' x 50', and 20' x 80'. Six additional furnaces, similar to the draw-back ovens in the Roll Processing Shop, are about 10' x 20'. A water-quench tank, including a spray unit for rolls, (a carborundum grit-blasting unit) complete the heat treating aisle. A 4,000-ton direct connected, pull-down, oil-hydraulic forging press is the major machinery in the 1970s addition. The press has a large forging ram, approximately 4' in diameter, flanked by two smaller ones. A hydraulic system changes the forging dies.

Two 200-ton Alliance manipulators run on rails on either side of the press and are controlled by manual and punch tape controls. The hydraulic systems are manufactured by Towler Hydraulics, Rodley, Leeds, England. Five pairs of electrically powered pumps are connected in parallel and produce 5,000 psi for the press. The Bliss press was primarily used for forged work rolls and some smaller forged shapes such as rounds, blooms and flats.

HISTORY

Press Shop No. 2 was financed by the Defense Plant Corporation to produce 17,000 tons of battleship armor and another 5,000 tons of "special" forging (presumably items like ship shafting) per year. When originally constructed, the Mesta press had only three pumps and was rated at 7,000 tons. That the Defense Plant Corporation constructed a 7,000-ton press instead of something larger, suggests that either the ingots were expected to be sounder or that the forging would be smaller than those produced on larger presses. When compared to Press Shop No. 1, the building layout shows the influence of the South Charleston Naval Ordnance Plant in the clear material flow and the consolidation of heating/forging and heat treating into a single building. Carnegie-Illinois operated the forge department at the South Charleston Plant for the Navy during World War II, which had several 14,000-ton forging presses. The 75-ton manipulator replaced a 20-ton manipulator. Installed in the early 1960s, the new manipulator handled the demand for increasingly larger generator and turbine shafting.

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Plancor.

U.S. Steel Drawings: HO-FS 360 (1943, rev. 1944), PD-219 (1970, rev. 1973).

<u>Historic Name</u>: U.S. Steel, Homestead Works, Machine Shop No. 1
<u>Present Name</u>: Park Corporation, Homestead Works, The Big Shop
<u>Location</u>: Munhall, Allegheny County, PA
<u>Construction</u>: 1899, 1925
<u>Documentation</u>: Photographs of Machine Shop No. 1 can be found in HAER No. PA-200-I.

DESCRIPTION

"The Big Shop," also known as the Valley Machine Shop and Machine Shop No. 1, measures (with two additions) 650' x 115' overall. Machine Shop No. 1 has a 60' high main bay with a two-story side bay on the south, and a separate office building. The main bay is a steel frame building with brick infill and a version of a rivetted Warren truss with glazed sawtooth features at both ends of the truss. An additional range of glass admits light from the north clerestory. The two additions to the main bay are clad in corrugated metal and use fiberglass panels instead of glazing. The side bay has a single slope Warren truss, prefabricated concrete panels between the floors, and metal sash windows. A babbitt shop, originally a narrow gauge locomotive repair shop, is in the southeast corner. Production planning offices and a ca. 1965 employee-built chapel occupy part of the second floor. "The Big Shop" office is a square, two bay by two bay, two-story brick building with gable roof and a one-story addition that connects it to the side bay. All shop floors are wood block. The "Big Shop" contains the following machinery.

<u>South side of main aisle, east to west</u>:
Cincinnati 96" Hypro vertical boring mill;
64" Giddings & Lewis vertical boring mill type -4;
Assembly/layout table 100" x 31' x 10 3/4";
Ingersoll 42" x 54"h x 300" planer miller;
Giddings & Lewis 60" x 84" high column vertical boring mill;
Giddings & Lewis Series 75 N/C vertical turret lathe;
Warner & Swasey 36" x 12' turret lathe;
LeBlond 25" x 126" lathe;
Rockford 60" vertical hydraulic slotter, type SM, or 67" x 72";
LeBlond 25" x 144" heavy-duty lathe;
Lodge & Shipley 25" x 102" lathe;
(lane to side entrance door);
LeBlond Model 4025 heavy duty milling lathe;
Two Giddings & Lewis, 60" x 60" positioning tables on a larger assembly table;
Kearney & Trecker, Milwaukee-Motion, centering machine, N/C;
Wallace automatic hydraulic bender [not original location];
Work assembly plate, 4' x 8';
Work assembly plate, 6' x 12';

Gallmeyer & Livingston Co. Model 70 Grand Rapids hydraulic tool cutter grinder;
6" Hammond double-end universal chip breaker and diamond finishing carbide grinder;
14" Hammond double-end carbide grinder Model 14-WD;
Grob No. 3 automatic drill pointer/grinder;

North side of main aisle, east to west:
Giddings & Lewis 8" floor-type horizontal boring mill Model 780F, 85" x 122";
Cincinnati 96" x 108" x 30' hypo combination planer/miller;
a second only bigger and about 79' long overall;
Ingersoll 24" x 18" key way milling machine;
Giddings & Lewis 6" table-type horizontal boring machine, Model 56T, 72" x 141" bed;
Giddings & Lewis 7" floor-type horizontal boring mill, Model 570 FUAR, 6'x 8' raised bed and 30' long positioning table;
Carlton 7' x 19" radial arm drill;
Southwark 600 ton parallel floor hydraulic wheel press;
300-ton hydraulic wheel press;
Despatch car bottom furnace;
two Gould & Eberhardt 24" plain mechanical shapers;

First floor of side bay, east to west:
Babbitt shop: assembly plate, melting furnaces;
24" U.S. Electric Tool Co. double-end snagging grinder, model 66;
two Cincinnati milling machines, 18" x 72" tables (1971);
Cincinnati horizontal milling machine, 18" x 72" table;
Lendiz cylindrical grinder, model CH, 14" x 72";
Cincinnati No. 2 tool and cutter grinder;
30" Ingersoll cutter grinder;
Barker-Coleman hob sharpener, model 10-12 ;
Warner & Swasey N/C turret lathe, 60 hp;
Warner & Swasey 18" x 36" turret lathe;
Grisholt 10" x 29' turret lathe, 25 hp;
Mitts & Merrill, Saginaw, Michigan, No. 7B hydraulic keyseater;
Gidding & Lewis Bickforn, N/C Drill press, 25" x 48" with drill bit changing system;

Upper level of side bay, east to west:
offices;
Employee Chapel;
Pfauter gear hobber (ca. 1915);
No. 24A Gleason bevel gear planer;
Gould and Eberhardt universal gear hobber, model 160-H;
54" Gleason automatic straight bevel gear planer;

Homestead's Armor Plate Deck Shop was constructed on this site in 1891. Like the No. 1 Press Shop and the Harvey Shop, the Armor Plate Deck Shop was expanded several times until it reached a maximum length of 530'. Armor plate for such Navy ships as the _Olympia_, _Maine_, and _Oregon_ was machined, bent, and test erected in the Deck Shop. The existing brick office building was constructed in 1899 for the Armor Plate Division. Part of the building was converted to a kitchen and dining room for non-union workers during the strike of 1892. In 1908, the first plant ever to manufacture steel wheels by the Slick process was installed in the building. The Wheel Works was closed in 1919 and at least part of the process was adopted by the Schoen Wheel Division of the Homestead Works, McKees Rocks, Pennsylvania. The building was converted to an employee cafeteria when the Slick Works was closed. The building was torn down and the existing structure was built in 1925 to serve as the General Repair Shop. However, the office building from 1899 was retained and incorporated into the new structure. The previous site of the General Repair Shop was converted at that time to the Main Roll Shop for the new Structural Mills. In more recent times the shop became responsible for general repair for all the U.S. Steel mills in the Monongahela Valley.

Sources:
Ashton, W. A. and R.N. Merk. "The Manufacture of Wrought Steel Wheels." _Iron and Steel Engineer_ 25 (December 1948): 37-47.

"Homestead Repair Shops Are Interesting." _Iron Trade Review_ 56 (April 1, 1915): 659-65.

Pittsburgh Post, July 20, 1892, 1.

"The Slick Wheel Mill." _Iron Age_ 102 (August 29, 1918): 491-498.

U.S. Steel Drawings: B-4 (1914, rev. 1927), FM-100 Part 1-B (1965, rev. 1980).

Historic Name: U.S. Steel, Homestead Works, Machine Shop No. 2
Present Name: Park Corporation, Homestead Works, Machine Shop No. 2
Location: Munhall, Allegheny County, PA
Construction: 1903, 1958, 1966
Documentation: Photographs of Machine Shop No. 2 can be found in HAER No. PA-200-J.

DESCRIPTION

Machine Shop No. 2 consists of an 85' tall, 500' x 200' main building with two three-story additions totalling 400' x 100', and an 150' high, 150' x 100' vertical furnace building. The main machine shop is a steel frame building with two main aisles under a single gable that combines features of riveted Pratt and Howe trusses. Two side bays flanking the main aisles have half-versions of the same truss. The walls are brick and have tall narrow windows. The east gable is stucco on lathe. The west gable, the clerestory, and the roof are corrugated metal. The additions have flat Warren trusses with a continuous monitor, corrugated metal roof and siding. Fiberglass panels run above and below the crane way on the north side. The vertical furnace building is constructed similarly to the additions, only taller.

On the north side of the north main bay the machinery is arranged, from east to west, as follows (all dimensions are estimates):

> (1) Cold-saw mounted with machine bed, Motch & Merryweather Machinery Co. label; (2) Betts 6' vertical boring mill; G.A. Gray Co., Cincinnati, Ohio, (3) Planer, machine bed is about 3' x 12'; (4) 6' vertical boring mill, King Machine and Tool Division, American Steel Foundries with Burney Machine Co, Pgh. label, (5) 10,000 lb pivot crane; (6) Betts 6' vertical boring mill; (7) Carlton drill press, 6' arm on 17' high column; (8) Ingersoll 412 miller, machine bed about 12' x 43', horizontal miller mounted on a tall vertical housing that is sunk into the floor about 6'; (9) Newton vertical boring mill; (10) Niles-Bement-Pond Co., Pond Works, Plainfield, New Jersey, lathe, about 6' chuck, supports and other parts of lathe are set on rectangular holes in a machined bed; (11) Marvel No. 18 hydraulic universal roll-stroke; (12) G.A. Gray Co., Cincinnati, Ohio, double housing planer with 5' x 25' machine bed.

On the south side of the north main bay the machinery is arranged, from west to east, as follows (all dimensions are estimates):

> (13) Betts boring lathe, No. 8515, 100+' long; (14) Mesta planer, cutting device mounted on a tall vertical housing that is sunk into the floor about 6' and moves along the length of 15' x 38' machined bed.

Laid out across the east end of both main bays the machinery includes:

> (15) Farrel-Betts lathe, Farrel-Birmingham Co., Consolidated Machine Tool Div., Watson-Stillman Press Div., Rochester, New York, 72" chuck x 100' long; (16) US Clearing, Chicago,

Ill., Clearing Axelson 6040, thread cutting lathe, 60" chuck x about 60' long; (17) Betts - Farrel boring lathe, 10' diameter chuck x 50' long; (18) Niles Tool Co., Hamilton, Ohio, boring lathe, 67' long; (19) An ECM welder, 12' high cylindrical unit with vertically moving arm, cylindrical unit moves sideways along the side of a metal bed/work area; (20) Lodge & Shipley lathe, last patent 1912; (21) Lipman grinder, 3 hp motor; (22) Gould & Eberhardt 24" industrial shaper; (23) Hammond chip breaker grinder and Hammond carbide tool grinder, Hammond Machinery Builders, Kalamazoo, Michigan; (24) A grinder with two 12" diameter wheels manufactured by Thomson grinder Co., Springfield, Ohio

The two additions to the Machine Shop No. 2 house the following machinery:

(25) A Reliance planer/miller 45" center; (26) an Ingersoll planer/miller, moved to site by U.S. Steel, but not installed; (27) a Farrel lathe 120" chuck x 72' long with two off-center tail stocks, nc controls, and 300-ton capacity; (28) a Scotia lathe with Simmons (Albany, New York) label, 124" chuck x 21'; (29) a Niles lathe 51" chuck x 110' long, Niles Tool Company, Hamilton Div., Baldwin-Lima-Hamilton Corp., Corp, Hamilton, Ohio; (30) a Carlton radial drill, 6' arm x 8' tall, not installed, moved from another location; (31) a 40' Skoda vertical boring mill, 250-ton capacity stencilled "Simmons"; (32) Farrel trepan lathe, 84 trepanner, 78" chuck x 100'; (33) and a Carlton radial drill 10' arm x 18' high.

Equipment in the Vertical Furnace Building includes:

(34) A vertical upender used to move the long forging from the horizontal to the vertical plane. (35) Seven vertical furnaces manufactured by Pennsylvania Industrial Engineers, Division of Amsler Morton. The furnaces refine the grain of and stress relieve rotors, and shafts up to 50' long and 6' in diameter. One furnace has a motor which rotates the forging. The natural gas burners are designed to swirl the flame around the forging without the flame touching the metal. (36) A steel-framed tower supporting a vertical quench uses water sprays, mist and/or air to cool the forging.

HISTORY

Built next to Open Hearth No. 3 and requiring the demolition of two pattern storage buildings, Machine Shop No. 2 was part of the 1903 expansion of the Armor Plate Division. Little, if any, pre-World War II machinery survives. Most appears to date from the 1950s through the 1970s. The additions and the Vertical Furnace Building were constructed as part of a post-war conversion to commercial forging, particularly turbine and generator shafts and nuclear pressure vessels. Vertical furnace buildings similar in operation to the Homestead installation were constructed at the South Bethlehem Works and the South Charleston Ordnance Plant and were used to heat-treat naval artillery.

Sources:
Making (1964), 1002-1005.

Sanborn Map Company, Homestead, 1901.

U.S. Steel Drawing: FM-100 Part 1-B (1965, 1980).

"U.S. Steel To Add To No. 2 Machine Shop at Homestead Works." Blast Furnace and Steel Plant 55 (April 1967): 52.

Historic Name: U.S. Steel, Homestead Works, Machine Shop No. 3
Present Name: Park Corporation, Homestead Works, Machine Shop No. 3
Location: Homestead, Allegheny County, PA
Construction: ca. 1942
Documentation: There are no photographs of Machine Shop No. 3.

DESCRIPTION

Machine Shop No. 3 is a 70' high, single-story steel-frame building, 106' wide x 690' long. The walls consist of 6" thick hollow-clay block, and the floors are primarily wood block. The roof truss is a variation of a flat steel Pratt with knee bracing. A strip of glazing runs along the clerestory level on the southeast side of the building. Rail access is available at each end of the building. Lubricating oil for the machinery is centrally distributed from large oil tanks and pumps. Most power and lubrication cables travel under the floor and are covered with metal plates.

The machinery in Machine Shop No. 3 dates from the 1940s through the 1960s and includes: eight lathes manufactured by Niles Tool Works Co, Hamilton, Ohio; two 72" heavy-duty lathes manufactured by Mackintosh-Hemphill; one lathe manufactured by Laughlin Barney Machinery Co., of Pittsburgh, with adjacent "Lincolnweld" arc-welding equipment; one lathe manufactured by I.H. Johnson Jr. & Co., of Philadelphia, connected to "Lincolnweld" equipment; one Marvel No. 18 hydraulic universal roll stroke manufactured by Armstrong-Blum Manufacturing Co.; one heavy-duty drill manufactured by Carlton, Cincinnati, Ohio; one hydro-planer milling machine manufactured by Giddings and Lewis Machine Tool Co., Fond du Lac, Wisconsin; one 60" lathe manufactured by Mackintosh-Hemphill; one circular milling machine manufactured by Vulcan-Rafamel, of Wilkes-Barre, Pennsylvania; and one circular milling machine manufactured by Gray Mfg. Co.

HISTORY

The Defense Plant Corporation built Machine Shop No. 3 to rough turn heavy forging. The presence of numerous boring lathes and the absence of numerous horizontal milling machines suggests that the Machine Shop was not used to make armor plate, but rather to rough-turn ship shafting.

Sources:
Dowlan, Neil. Field Documentation.

Ess, T. J. "War Time Expansion of Carnegie-Illinois Steel Corporation in the Pittsburgh District." Iron and Steel Engineer 24 (September 1947): 13-32.

U.S. Steel Drawing: HO-FS 360 (1943, rev. 1944).

Historic Name:	U.S. Steel, Homestead Works, Harvey (or Carbonizing) Shop
Present Name:	Park Corporation, Homestead Works, Harvey (or Carbonizing) Shop
Location:	Munhall, Allegheny County, PA
Construction:	1893, 1902, 1904, 1913, 1939
Documentation:	Photographs of the Harvey Shop can be found in HAER No. PA-200-M.

DESCRIPTION

The Harvey Shop is 72' high, 1000' x 130', steel frame building with a main aisle flanked by side aisles, or lean-tos. It was built in five different stages. The original building is 230' long, with pin-connected Fink truss and monitor roof.

The first addition is 184' long and structurally identical to the original building. The second extension, about 98' long, also incorporates a pin-connected Fink truss with a monitor but it is more heavily cross-braced. The third extension is 138' long, and has a riveted Fink truss with a monitor roof. The fourth addition is a riveted Fink truss with ventilators. A small one-story brick building with arched lancet windows is built onto the southeast corner and once contained transformers.

The building contains fourteen coke oven gas-burning car-bottom heat treating furnaces ranging in size from about 14' wide x 20' high x 80' long (2), 15' wide x 20' high x 38' long (10), and 10' wide x 20' x 25' long (1).

The building also contains an area with small furnaces that may have been used to run metallurgical tests. A Mesta horizontal double housing planer with a machine bed about 40' x 15' stands nearby. Also located in the fourth addition, is a heavy roller leveller built by Mesta and claimed in 1941 to be the largest of its type in the country. The leveller has hydraulic entry and delivery pinch rollers, two over three work rolls about 15" in diameter, and is capable of levelling plate 18' wide x 1 3/4' thick. Each of the upper work rolls has a backup roll system composed of three shorter rolls placed end to end to provide stiffness. A 12' high accumulator stores hydraulic power for the pinch rollers.

HISTORY

The Carbonizing Shop is commonly referred to as the Harvey Shop after Hayward Augustus Harvey. Harvey developed a face-hardening process for open-hearth steel. The Navy, in turn, developed the process for armor plate. In August 1891, a "Harveyizing" furnace was built at Homestead, presumably in the Press Shop. The Harvey Shop was constructed to face-harden plates forged on the Whitworth forging press (installed in 1893). The second expansion began in 1902 — a year after Theodore Roosevelt's inauguration — in order to meet the government's request for a doubling of armor plate production. The two bays of the second extension were originally part of Press Shop No. 1 and were moved in the course of adding extension for the Bethlehem press to the Press Shop. The third and fourth expansion coincide with preparations for both World Wars. After World War II, the Harvey Shop heat treated homogenous plates. After the installation of the continuous plate treatment line for the 160" mill, this plate heat treating was limited to thicker gauges.

<u>Sources</u>:

"Battleship Armor - 200-Ton Chunks of Jewelry Steel." <u>Iron Age</u> 149 (January 1, 1942): 70-71.

Cooling, Benjamin Franklin. <u>Gray Steel and Blue Water Navy: The Formative Years of the Military-Industrial Complex, 1881-1917</u>. Hamden, Conn.: Archon Books, 1979.

Dowlan, Neil. Documentation of the furnaces.

Misa, Thomas Jay. "Science, Technology and Industrial Structure: Steelmaking in America, 1870-1925." Ph.D. dissertation, University of Pennsylvania, 1987.

"Picture Story of Armor Plate." Iron Age 148 (July 24, 1941): 93a-b.

STAINLESS STEEL PROCESSING PLANT

<u>Historic Name</u>: U.S. Steel, Homestead Works, Stainless Steel Processing Plant
<u>Present Name</u>: Park Corporation, Homestead Works, Stainless Steel Processing Plant
<u>Location</u>: Munhall, Allegheny County, PA
<u>Construction</u>: 1969
<u>Documentation</u>: Photographs of the Stainless Steel Processing Plant can be found in HAER No. PA-200-O.

DESCRIPTION

The Stainless Facilities consist of three adjacent bays constructed to do final finishing on stainless and armor plate rolled on the 160" Mill. The Stainless Processing, Shipping and Armor Plate Processing Buildings are steel-frame buildings about 75' high with compound fan trusswork, concrete floors, corrugated metal siding and roofing, and fiberglass panel windows.

The Stainless Processing Building is approximately 600' x 120'. A gantry crane runs the entire length of the east wall. Plates with thickness between .187" and .500" and up to 156" wide are cold levelled by a precision roller leveller manufactured by Lee Wilson. The rolls are about 4" in diameter and arranged nine over eight in addition to two sets of pinch rolls. The delivery table was manufactured at U.S. Steel's Johnstown works. A vacuum gantry crane places the levelled plate on the castor bed for the rotary shear manufactured by Froriep of Germany. About 80' x 130' overall, the rotary shear cuts plate up to 1" thick in widths from 5" to 180" and with 1/32" tolerances. A rack and pinion manipulator grabs the plate and aligns it under the shear. The shear cuts the plate by pulling overlapping rotary knives across the plate.

Adjacent to the rotary shear is a transfer car that connects all the buildings in the Stainless Facilities. A plate turnover rig and inspection tables are located against the east wall. At the south end of the building are three brick-lined pickling vats. Two are used for sulfuric and nitric/hydrofluoric baths, while the third serves as a rinse. Storage tanks are outside the building. Along the west wall is a Wheelabrator vertical grit blaster which turns plates on edge and uses rotary impellers to bombard them with metallic shot. While grit blasting helps detect cracks, the treatment is largely cosmetic.

The Shipping Building is approximately 600' x 120'. The north end contains two plasma-arc cutters made by Thermal Dynamic

Corp., with photo tracing, dial-a-path and manual controls capable of custom cutting 6" thick plate. Adjacent to the plasma-arc beds is an area with raised metal bed surrounded by a sheet metal fence for a cold saw. The south half of the building is empty except for one of two Getty cherry pickers installed to travel along a now empty plate storage area. From the vantage point of the cherry pickers, employees moved plates via radio controlled overhead cranes.

Armor Plate Processing was done in a 700' x 120' bay. Remaining equipment includes a Wheelabrator horizontal grit blaster, a plate turning rig, a paint room, the foundations of an abrasive belt grinder (to grind irregularities in the armor), and a magnetic gantry crane. The original installation also contained a inspection tables, an ultrasonic bath to check armor plate for cracks, and a painting line.

HISTORY

The Stainless Facilities were constructed in 1969 in response to high demand for stainless plate as well as for homogeneous armor plate used by the Navy for nuclear submarines. These are the last new production facilities added to the Homestead Works.

Sources:

Hornak, Raymond. Superintendent of the Homestead Structural Mill 1978-1983. Interviewed by author, March 12, 1990.

Jacoby, Stanley. ASKO, Interviewed by author, Spring 1990.

"Showcase of Stainless Facilities Starts Up at Homestead." U.S. Steel News 34 (July-August 1969): 10-12.

U.S. Steel Drawing: HO-PL 9853 (1968).

AUXILIARY BUILDINGS AND SHOPS

Historic Name: U.S. Steel, Homestead Works, Slab and Plate Mill Office
Present Name: Park Corporation, Homestead Works, Slab and Plate Mill Office
Location: Homestead and West Homestead, Allegheny County, PA
Construction: 1942
Documentation: Photographs of Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

This two-story, 71' x 61' red brick building with basement entrance was designed by Pittsburgh architects LeRoy L. Hoffman & Kenneth R. Crumpton. The asymmetrical building has a restrained modernistic exterior that includes a vertical panel of glass block that lights the central staircase. This feature is flanked to the left by projecting brick courses that wrap around the corner in horizontal bands, and on the right by a contrasting masonry course below the first floor windows that continues around to the projecting side staircase. A concrete slab carport was added onto the upstream side at a later time.

HISTORY

The Slab and Plate Mill Office was constructed by United States Steel just outside the Defense Plant boundary near the 160 Mill Motor Room. The interior has been completely redone. Hoffman and Crumpton designed Homestead's General Office Building about a decade later.

Sources:

Obituary, Kenneth R. Crumpton, biography file, Art and Music Division, Carnegie Library, Pittsburgh.

U.S. Steel Drawings: HO-PL-43 (1942); FM-100 part III (1945, 1980).

Historic Name: U.S. Steel, Homestead Works, General Office Building
Present Name: Park Corporation, Homestead Works, General Office Building
Location: Homestead, Allegheny County, PA
Construction: 1956
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

Designed by LeRoy L. Hoffman and Kenneth R. Crumpton of Pittsburgh, this five-story (plus machinery penthouse), 325' x 50' steel-frame office building is clad in stainless steel. Enclosed staircases on the narrow sides of the building and the rear wall that connects them are clad in "U.S. Steel blue" porcelain enamel panels. The USS logo is displayed prominently on the staircase towers and the wing shaped entrance canopy.

HISTORY

The General Office Building was constructed in 1956 as part of a general plant modernization and expansion program which included the plate treating line of the 160" mill, the finishing end of the structural mill, and the move into large commercial forging. The architects showcased the architectural possibilities of stainless steel sheet and incorporated the International Style which was widely popular with American corporations after World War II. According to Iron and Steel Engineer, the building was believed to be "the first stainless steel curtain wall office building ever built," though stainless had been previously used to great effect on the Chrysler Building. The former General Office located at Eight Avenue and Harrison Street, Munhall, burned in 1945 and the company used space in the Carnegie Library until this structure was built. One of the most successful International Style designs in the region, the building was demolished in 1990.

Sources:

"Building Has New Type of Construction." Blast Furnace and Steel Plant 45 (January 1957): 80.

"Curtain Wall Construction Opens New Market." Iron and Steel Engineer 33 (December 1956): 175.

Obituary, Kenneth R. Crumpton, biography file, Art and Music Division, Carnegie Library, Pittsburgh.

Historic Name: U.S. Steel, Homestead Works, Structural Mill Office
Present Name: Park Corporation, Homestead Works, Structural Mill Office
Location: Munhall, Allegheny County, PA
Construction: 1926
Documentation: Photographs of Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

This two-story, hip roof, four bay, 50' wide x 30' deep, buff brick office building is raised above ground level on a concrete foundation. The steel sash windows are recessed between brick piers that contain recessed vertical panels. The floor spandrels are recessed with corbeling. The foyer occupies the third bay from the left as you face the building. It contained a display of light structural sections rolled at Homestead.

HISTORY

This office replaced a wood frame structure located nearby when the structural mill was modernized in 1925-26. The earlier office was located next to the storage yards for the 35" finishing mills. The brick building was demolished in 1990.

Source:
U.S. Steel Drawing: FM-100 Part 1-C (1965, 1980).

Historic Name: U.S. Steel, Homestead Works, Metallurgical [or Physical Testing] Lab
Present Name: Park Corporation, Homestead Works, Metallurgical Lab
Location: Homestead, Allegheny County, PA
Construction: 1961
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The Physical Testing Lab is a three-story building with basement and machinery penthouse, and measures approximately 175' x 52'. The main stories are clad in light blue panels separated by vertical stainless steel ribs that recall the treatment of the General Office Building.

HISTORY

The status of the interior is unknown, but the building housed equipment for tests such as tensile strength and fracture.
Source:
U.S. Steel Drawing: FM-100 Part II (1957, rev. 1980).

Historic Name: U.S. Steel, Homestead Works, Manganese Bins
Present Name: Park Corporation, Homestead Works, Paint Shop
Location: Munhall, Allegheny County, PA

Construction: ca. 1900
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The Paint Shop is a 136' x 25' corbelled one-story brick building with riveted-steel trusses and a corrugated metal roof. The walls have shallow buttresses.

HISTORY

It seems likely that the Paint Shop is the structure labeled as manganese bins on a 1901 Sanborn map. The location near the (former) southwest corner of Open Hearth No. 3 and the long narrow shape seems to confirm this conclusion. The structure, however, is not on a 1906 company map and the Facilities Map (which records the date and construction of buildings) dates the Paint Shop to 1911. On the other hand the later map is unreliable for early dates. Manganese, in the form of spiegelesien or ferromanganese, was used in open hearths to eliminate sulphur from the molten steel.

Sources:
Making (1951), 291.

Sanborn, Homestead, 1901.

U.S. Steel Drawing: FM-100 Part 1-B (1965, rev. 1980), G-1816 (1906).

Historic Name: U.S. Steel, Homestead Works, General Labor Building
Present Name: Park Corporation, Homestead Works, General Labor Building
Location: Munhall, Allegheny County, PA
Construction: ca. 1915
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

Described as the Labor Shelter and Comfort Station in 1945, this two-story brick building is approximately 54' x 50' overall with a corner severely beveled to accommodate a turn in a rail line. The sides and the roof are covered with sheet metal. Offices and parts storage occupy the first floor, and lockers and lavatories the second.

HISTORY

Built about the time of World War I, the General Labor Building served as an office and locker/sanitation building for the plant's labor crews. The lavatory was built in 1937. The structure has been demolished.

Sources:
Carnegie Steel Corp. Rolling Mills, 1945. Collection of Pittsburgh History and Landmarks Foundation (PHLF).

U.S. Steel Drawing: FM-100 Part 1-C (1965, rev. 1980).

Historic Name: U.S. Steel, Homestead Works, Chemical Lab
Present Name: Park Corporation, Homestead Works, Chemical Lab
Location: Munhall, Allegheny County, PA
Construction: ca. 1929
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The Chemical Lab is an irregularly-shaped five-story buff brick building approximately 60' x 45' with a concrete basement. The basement contains a locker room and a cluster of machines used to prepare samples for testing. A pneumatic tube system connected the floors. Hoods, a spectrometer, acid testing equipment, paper supplies, and ventilation equipment occupy the other floors.

HISTORY

Each open hearth contained small metallurgical labs used to monitor the carbon content of each heat, or batch, of steel. After the heat was tapped samples were sent to the Chem Lab for more detailed analysis. The building was demolished in 1990.

Sources:
Dedik, Michael. Metallurgical Observer, Homestead Works. Interviewed by author, December 18, 1989.

U.S. Steel Drawing: FM-100 Part 1-C (1965, rev. 1980)

Historic Name: U.S. Steel, Homestead Works, Template and Tin Shop
Present Name: Park Corporation, Homestead Works, Sign Shop
Location: Munhall, Allegheny County, PA
Construction: 1914

Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

This two-story, 75' x 30', eight by two bay building has orange-yellow brick with corrugated roof, wood purlins, riveted steel trusses and two ventilators. Two bays were added to the east end at an unknown date. About half of the segmental arch windows have been blocked, and others have had their sashes replaced. A covered walkway enclosed with corrugated metal connects the second floor of the Sign Shop to the Carpenter Shop. The first floor may have served as an office/employee lunch room and the second floor contains graphic art equipment.

HISTORY

While originally constructed as a template shop for rolls, by 1928 the second floor of the building became a tin shop. The addition was added by 1945. Sometime after 1945 the building was converted to its present use.

Sources:
Carnegie Steel Corp. Rolling Mills, 1945. Collection of PHLF.

General Statistics, map (revised 1912).

"Homestead Repair Shops Are Interesting." Iron Trade Review 56 (April 1, 1915): 659-65.

U.S. Steel Drawing: FM-100 Part 1-B (1965, 1980).

Historic Name: U.S. Steel, Homestead Works, Carpenter and Pattern Shop
Present Name: Park Corporation, Homestead Works, Carpenter and Pattern Shop
Location: Munhall, Allegheny County, PA
Construction: 1901
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The Carpenter Shop is an approximately 151' x 50', two-story steel frame building with brick infill, segmental arch windows, and corrugated metal gables. Most of the windows are blocked. Riveted Fink trusses with knee braces support the corrugated asbestos roof and a single ventilator. The first floor has a wood block floor and retains some of the wood working equipment. Patterns are stored on the second floor of the Carpenter Shop as well as in the adjacent Pattern Storage Building. The north end of the second floor is a locker room. A small square two-story office addition was built to the northeast corner shortly after the original construction. Bridges connect the Carpenter Shop to the adjacent Sign Shop (enclosed with sheet metal) and Pattern Storage Building (open wood deck).

HISTORY

The Carpenter Shop made wood patterns for replacement iron or steel castings. At least originally, the rough woodworking was done on the first floor and the actual pattern making on the second. The storage of large numbers of patterns on the second floor suggests a change of use in more recent times. Casting was done at the Edgar Thomson Works' Foundry or, to a lessor extent, at the armor plate mould foundry that was located near the 48" Mill. The bridge between the Carpenter Shop and the Pattern Storage Building provided access to the Pattern Storage Building's elevator and stairs.

Sources:
"Homestead Repair Shops Are Interesting." Iron Trade Review 56 (April 1, 1915): 659-65.

Sanborn, Homestead, 1901.

U.S. Steel Drawing. FM-100 Part 1-B (1965, 1980).

Historic Name: U.S. Steel, Homestead Works, Pattern Storage Building
Present Name: Park Corporation, Homestead Works, Pattern Storage Building
Location: Munhall, Allegheny County, PA
Construction: ca. 1902
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The majority of the wooden patterns made in the Carpenter Shop are stored in this four-and-one-half-story, 200' x 50' steel frame building with brick infill. Designed to reduce the risk of fire, the Pattern Storage Building has riveted Fink trusses, narrow cast metal shutters in the gable ends of each floor, counter-weighted trap doors between flights of the wooden staircase, and a corrugated asbestos roof. Wood floors reduce possible damage to the patterns and are supported by steel beams. A wooden decked bridge connects the second floor with the Carpenter and Pattern Shop. An outside elevator is located near the northwest corner of the building. East of the elevator is an open brick storage area covered by a half Pratt truss. Hundreds of patterns are still stored in the building.

HISTORY

The Pattern Storage Building replaced two earlier storage buildings that were demolished in 1903 to make room for a new armor plate machine shop, now Machine Shop No. 2.

Sources:
General Statistics. map, revised 1912.

"Homestead Repair Shops Are Interesting." Iron Trade Review 56 (April 1, 1915): 659-65.

Sanborn, Homestead, 1901.

U.S. Steel Drawing: FM-100 Part 1-B, (1965, 1980).

Historic Name: U.S. Steel, Homestead Works, Brick and Cement Storage Building
Present Name: Park Corporation, Homestead Works, Brick and Cement Storage Building
Location: Munhall, Allegheny County, PA
Construction: ca. 1906
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

Refractory brick for the furnaces and soaking pits was stored in a triangular, 300' x 65' one-story brick building with exposed steel frame, corrugated metal roof, and ventilators. The space is covered by parallel bays with riveted-steel Pratt trusses running perpendicular to the length of the building. A trussed awning shelters the north wall of the shed. A two-story corbelled brick office, about 76' x 40', stands at the east end of the Brick Shed and was built in 1937. Additional storage space was used in numerous lean-tos and cubby holes in the southeast end of the adjacent Roll Processing Building.

HISTORY

The Homestead Works, at one time the largest open hearth plant in the world, needed a wide variety of refractory brick for the open hearths, soaking pits, and heat-treating furnaces. The Brick Shed presumably stored much of this essential material.

Source:
U.S. Steel Drawings: G-1816 (1906); FM-100 Part 1-B (1965, 1980).

Historic Name: U.S. Steel, Homestead Works, South Cinder Yard
Present Name: Park Corporation, Homestead Works, South Cinder Yard
Location: Homestead, Allegheny County, PA
Construction: ca. 1942, 1957
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The South Cinder Yard measures 810' (including a 270' extension) x 88' and is about 62' high. The structure has a steel frame with concrete foundations and a slag floor. The sides of the Cinder Yard are clad on the inner side of the steel frame with long narrow horizontal metal strips. The steel frame and its Fan type of Fink trusses are covered with wire mesh above the level of crane girders. Two rail lines enter from the southwest end.

HISTORY

The South Cinder Yard was constructed by the Defense Plant Corporation to break up slag from Open Hearth No. 5. A large steel ball was dropped from the overhead crane onto the slag. The mesh and the siding were designed to contain flying slag fragments. This structure was known as the South Cinder Yard because another cinder yard, not extant at the time of the survey, was constructed on the opposite side of Open Hearth No. 5. The addition was constructed in 1957, about the time that the furnaces in Open Hearth No. 5 were enlarged.

Sources:
Making (1951), 441.

Plancor.

U.S. Steel Drawing: FM-100 Part II (1957, rev. 1980).

Historic Name: U.S. Steel, Homestead Works, South Scrap Drop

<u>Present Name</u>: Park Corporation, Homestead Works, South Scrap Drop
<u>Location</u>: Homestead, Allegheny County, PA
<u>Construction</u>: ca. 1940
<u>Documentation</u>: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The Scrap Drop is a six-story, 378' x 76', steel-frame structure with concrete foundations and a slag floor. The sides of the Cinder Yard are clad on the inner side of the steel frame with long narrow horizontal metal strips. Above the crane way, the steel frame and its flat Warren truss is open to the sky.

HISTORY

One of two such structures constructed by the Defense Plant Corporation, the Scrap Drop used a heavy steel ball dropped from the overhead crane to break up scrap for the furnaces in Open Hearth No. 5.

<u>Sources</u>:
<u>Making</u> (1920), 411.

U.S. Steel Drawing: FM-100 Part II (1957, 1980).

<u>Historic Name</u>: U.S. Steel, Homestead Works, Steam Department
<u>Present Name</u>: Park Corporation, Homestead Works, Heat Treating and Forging Office
<u>Location</u>: Munhall, Allegheny County, PA
<u>Construction</u>: ca. 1904
<u>Documentation</u>: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

This two-story, 39' x 62' red-brick office building has narrow arched windows and corbeling under the eaves of a sheet metal roof. The windows have been partially blocked with a lighter brick and the glazing replaced with single pane sash and glass block. The first floor is an office for the Forging Division and the second floor is a locker room.

HISTORY

The Forging Office was constructed about the same time as the adjacent Machine Shop No. 2 and the extension of Press Shop

No. 1 for the 12,000 ton Press. The building was modified in some way in 1935.

Sources:
Carnegie Steel Corp. Rolling Mills, 1945. Collection of PHLF.

General Statistics, (1912). Map revised in 1912.

U.S. Steel Drawing: FM-100 Part 1-B (1965, rev. 1980); Site map (1928).

Historic Name: U.S. Steel, Homestead Works, S.T.S. Shop
Present Name: Park Corporation, Homestead Works, Roll Processing Shop
Location: Munhall, Allegheny County, PA
Construction: 1941
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The Roll Processing Shop is a 72' high building measuring 1000' x 100', with a 30' wide side bay. The corrugated metal clad steel-frame building has riveted Fink trusses with ventilators and concrete foundations and floors. Fiberglass panels in the north clerestory provide some light. A two-story office is a located on the west end of the side bay and was used by Naval inspection officials. Narrow-gage locomotives were repaired in a one story concrete building on the east end of the main bay which has Fink trusses, ventilators, and a corrugated metal roof. Starting with the west end of the side-bay going east, then east to west in the main bay, the Roll Processing Shop contains the following equipment:

(1) nine draw, or Coleman, core and mold ovens, Foundry Equipment Co., Cleveland, Ohio, fueled by natural gas; (2) test cutter, Taylor Wilson Mfg., McKees Rocks, type FD1; (3) Giddings Henig, Fond du Lac, Wisconsin, horizontal boring machine; (4) Niles, 24" chuck x 19' trepan lathe, Hamilton, Ohio; (5) 36" Stamets body chucking lathe with numerical controls; (6) Selas roll heat treating processing equipment, constructed 2/21/67, Dresher, Pennsylvania [one matched set of two furnaces and a spray quench plus the foundation and controls for a second]; (7) quenching tank.

Equipment removed from various other places within the site, including the Blacksmith Shop: (1) two steam hammers, Niles Bemont Pond; (2) two small coke gas fueled furnaces, Buffalo forge, Buffalo, New York, patent date: 1894; (3) 24" industrial shaper, Gould and Eberhardt, Newark, New Jersey, supplied by Motch and Merryweather Machine Co., Pittsburgh; (4) 24" Hendig crank shaper, Hendig Machine Co., Torrington, Connecticut, with label of Barney Machine Co., Pittsburgh; (5) 24" industrial universal shaper, Gould and Eberhardt, label from Motch and Merryweather, Pittsburgh; (6) another 24" shaper; #5 Cincinnati universal miller, label from Motch and Merryweather, last patent: 1924; (7) J & G thread cutting table; a turret lath; Warner & Swasey Co., N1A universal hollow hexagon turret lathe; (8) Sidney Machine Tool Co. Inc., Sidney, Ohio, thread cutter, made 1/8/1948; (9) also moved to this building is much electric switching equipment and arc welding equipment.

HISTORY

This building was constructed in 1941 as the Specially Treated Steel (S.T.S.) Shop for the Navy under a separate contract separate from the Defense Plant. S.T.S. is an ultra-service, high tensile strength steel developed during World War II to conserve scarce alloy additives. The building contained batch furnaces to heat treat the rolled plates — a process ultimately made obsolete for gauges under 2" by the Plate Treatment Line of the 160" Mill. The building was converted to the production of cold reduction rolls for strip mills in the late 1960s or early 1970s. The equipment drills or trepan the core from forged rolls, cuts the journals, and hardens the roll surface. The Roll Processing Shop supplied rolls for all of U. S. Steel's cold strip mills.

<u>Sources</u>:

Sudo, Ed. Metallurgist at the Homestead Works, 1960-1983. Interviewed by author, September 1989.

U.S. Steel Drawing: FM-100 Part 1-B (1965, 1980).

<u>Historic Name</u>: U.S. Steel, Homestead Works, 100" Plate Mill Roll Shop
<u>Present Name</u>: Park Corporation, Homestead Works, 100" Plate Mill Roll Shop
<u>Location</u>: West Homestead, Allegheny County, PA
<u>Construction</u>: ca. 1917
<u>Documentation</u>: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The 100" Mill Roll Shop measures 54' high x 200' long x 80' wide. The steel-frame building has riveted Warren trusses surmounted by two sawtooth skylights facing opposite directions. The roof is corrugated metal, and the floors are wood block. The equipment includes a 24' long lathe with an approximately 6' chuck manufactured by Lewis Foundry, Pittsburgh, PA; a 14' long Simons, Albany, NY, grooving lathe with a 3' chuck; a 20' long Cincinnati Roll Grinder with a 3' chuck. The shop also contains roll racks and two tool grinders. A transfer car connects the Roll Shop to the 100" Mill Building.

HISTORY

The 100" Mill Roll Shop incorporates part of the 110" plate mill, but the precise nature and extent is unclear. While the roof truss is a continuation of the 110" Mill Shipping Building, the building also occupies space where the 110" plate mill stood.

<u>Source</u>:
U.S. Steel Drawing: FM-100 Part III (1945, rev. 1980).

<u>Historic Name</u>: U.S. Steel, Homestead Works, 110" Plate Mill Office
<u>Present Name</u>: Park Corporation, Homestead Works, 110" Plate Mill Office
<u>Location</u>: West Homestead, Allegheny County, PA
<u>Construction</u>: 1917
<u>Documentation</u>: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

This brick building is about 240' x 40' overall and has a two-story office section with a vehicle passage cut through the first floor and a one-story garage section. Many windows have been filled in and the others have been shortened.

HISTORY

The building was designed as an office, auxiliary machinery, and locker building for the 110" or "Liberty" Plate Mill. One section of the second floor dates to the early 1940s. The garage is a later addition.

<u>Sources</u>:
"The Liberty Mill of the Carnegie Steel Co." <u>Iron Age</u> 101

(January 3, 1918): 18-22.

U.S. Steel Drawing: FM-100 Part III (1945, rev. 1980).

Historic Name: U.S. Steel, Homestead Works, Construction Warehouse
Present Name: Park Corporation, Homestead Works, Construction Warehouse
Location: Homestead, Allegheny County, PA
Construction: 1957
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

This one-story "L"-shaped building has legs measuring 150' and 120' long and 50' wide. Built on a raised concrete platform, the building is constructed of welded-steel beams and metal siding. It does not have a truss.

HISTORY

Attached to the engineering department, the building housed materials and supplies needed for new jobs. The building currently contains archives and paper supplies.

Sources:

Gaughan, William J. Metallurgist at the Homestead Works. Interviewed by author, March 6, 1991.

Hornak, Raymond. Superintendent of the Homestead Structural Mill, 1978-1983. Interviewed by author, March 12, 1990.

U.S. Steel Drawing: FM-100 Part II (1957, rev. 1980).

Historic Name: U.S. Steel, Homestead Works, Store Room No. 2 and Oil House
Present Name: Park Corporation, Homestead Works, Store Room No. 2 and Oil House
Location: Homestead, Allegheny County, PA
Construction: 1946
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The one-story Oil House and two-story Store Room are brick buildings built over a single basement with overall dimensions of 300' x 50'. An open court separates the two structures. The Store Room has a loading dock and a small two-story office. Tools and other supplies purchased from outside suppliers, such as stationary, were kept in Store Room No. 2. The Oil House housed oil drums.

HISTORY

In 1946 U.S. Steel erected these two brick buildings near the Rusin Hall to serve as storage areas for office supplies, as well as a facility for storing oil drums. The stretcher-bond brick walls contain no ornamentation.

Sources:

Hornak, Raymond. Superintendent of the Homestead Structural Mill, 1978-1983. Interviewed by author, March 12, 1990.

U.S. Steel Drawing: FM-100 Part II (1957, rev. 1980).

Historic Name: U.S. Steel, Homestead Works, 45" Slabbing Mill Ingot Stripper
Present Name: Park Corporation, Homestead Works, 45" Slabbing Mill Ingot Stripper
Location: West Homestead, Allegheny County, PA
Construction: 1942
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The 45" Slabbing Mill Ingot Stripper was housed in a 246' x 70' x 100' building with a clearance of 73' for two overhead ingot stripper cranes. Open at ground level on all sides, this steel frame building is entirely sheathed in corrugated metal with fan-type Fink trusses supporting an open monitor roof. The ingot strippers are equipped to strip both big end up and big end down ingots. Hoists of 75 and 50 ton capacity are equipped with 400 and 200-ton screws respectively.

HISTORY

Constructed for the Defense Plant, the 45" Mill Ingot Stripper removes or strips ingots cast in the open hearths from their molds. The ingots are taken to the soaking pits for reheating. The molds are returned to the open hearth for reconditioning. If production volume is high and/or there is a shortage of molds, the stripped molds are cooled in the Mould Spray.

Source:
Plancor.

Historic Name: U.S. Steel, Homestead Works, Mould Spray
Present Name: Park Corporation, Homestead Works, Mould Spray
Location: Homestead, Allegheny County, PA
Construction: ca. 1942
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

This roofless, 40' x 150' steel-frame and corrugated-sheet structure has water sprays mounted on both sides of two rail lines. Water is sprayed on the ingot molds to cool the molds after the ingots have been stripped in the 45" Mill Stripper.

HISTORY

Constructed for the Defense Corporation, the Mould Spray was needed for war time production when there was an insufficient supply of ingot molds. During periods of low production, ingot molds were air-cooled before they were conditioned for teeming.

Source:
Plancor.

Historic Name: U.S. Steel, Homestead Works, Rusin Hall
Present Name: Park Corporation, Homestead Works, Rusin Hall
Location: Homestead, Allegheny County, PA
Construction: 1919
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

Rusin Hall is a three-story, 100' x 40' brick office building with a reinforced concrete foundation. The front entrance is a two story block with a doorway projecting at a right angle to the front facade. Shallow buttresses project from the sides. A series of four multi-story windows on each side have been altered with brick and glass block and reflect the insertion of a floor or floors. A one story brick garage has been added to the east side. The bulk of the first floor, raised above the entrance hall by a flight of stairs, is divided by lightweight partitions for offices and storage. The entrance hallway and the first floor preserve vestiges of a simple wooden cornice and a plaster ceiling. Lockers and a power and fuel accounting office are on the second floor. There is also a basement containing electrical switching and more locker space. Part of the second story appears to be blocked off from the city side of the building, where the cornice ends abruptly and a thin timber partition seems to have been added.

HISTORY

Rusin Hall was built by Russky-Narodny-Dom, Inc. as a fraternal hall for Ruthenian immigrants. Designed by Homestead architect A.G. Wickerham, Rusin Hall had a 350 seat auditorium, stage, balcony, grille or dining room, billiard room and men's and women's rest rooms, checkrooms, and parlors. The front facade with a Doric balcony was separated from the gable roof of the auditorium by an intermediate block. Demolished in 1990, Rusin Hall was the only structure to survive the 1940s demolition to make way for the Defense Plant. The reason for its survival is unclear, but it has served numerous functions including the Superintendent's office and a conference hall. The new entrance was added in 1955 when the new General Office Building required the demolition of the southeast corner. The balcony may also have been removed at that time.

Sources:
Miner, Curtis. "Engineering the Industrial Diaspora: Homestead and the Mill Expansion of 1941." Lecture given at the Historical Society of Western Pennsylvania, November 1, 1989.

U.S. Steel Drawings: FP 70 (1918).

Historic Name: U.S. Steel, Homestead Works, 160" Mill Roll Shop, 45" Mill Roll Shop, and Locomotive Repair
Present Name: Park Corporation, Homestead Works, 160" Mill Roll Shop, 45" Mill Roll Shop and Locomotive Repair
Location: West Homestead and Homestead, Allegheny County, PA
Construction: ca. 1942
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

Approximately 450' x 70', this 50' high steel-frame building is clad in 6" thick hollow-clay block. The truss is a riveted Warren with one-half the vertical members. There are standard ventilators over the roll shop section and a continuous ventilator over the standard gauge locomotive repair area. Two strips of glazing, above and below the crane way, illuminate the work area from the southeast side. The roll shop area has wood block flooring and two concrete pits provide access to the underside of the locomotives. A decorative metal work entrance on the southeast identifies one of several offices on the southeast as a pipe shop. Equipment includes a grinding lathe. Storage racks hold numerous rolls. Transfer cars connect the building with the 160" and 45" mills.

HISTORY

The Defense Plant Corporation built the shop to grind and dress roll for the 45" and 160" mills. It is not clear whether the pipe and locomotive repair shops were part of the original installation or added at a later time.

Source:
Plancor.

Historic Name:	U.S. Steel, Homestead Works, 140" Mill Building
Present Name:	Park Corporation, Homestead Works, 140" Mill Building
Location:	Munhall, Allegheny County, PA
Construction:	ca. 1888, 1904
Documentation:	Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The large 140" Mill Building measures approximately 950' x 230' and is about 65' tall. Covered with corrugated metal, the steel-frame building is composed of seven major sections: 1.) Pin-connected Fink truss monitor, dirt floor with transversely mounted overhead crane. 2.) Pin-connected Fink truss with monitor continues from section 1, but the crane runs longitudinally — except over a section on the east that is a fenced-in parts storage area. (Outside this area to the east, is located section 7.) 3.) Narrow transverse bay with concrete floor and riveted Fink trusses connected to the axis of the adjacent sections by a groined truss. 4.) Riveted Fink with transverse crane and slag floor. 5.) Three dirt floor bays have longitudinal cranes ways under one gable with Fink trusses. One column, probably a repair, has high strength bolts. The southwest corner of this section is beveled with the corner column outside the cladding. This section also has a lean-to along part of its length. The lean-to has Pratt trussing and a brick exterior wall. 6.) Riveted Fink with monitors, slag floor, two rows of windows with brick infill once site of boilers. Separated from section 5's lean-to bay by ash chutes visible on outside. 7.) One story brick structure in partial ruins old electrical equipment and round arch doors/windows. The entire building is currently used for parts storage.

HISTORY

The 140" Mill Building once housed both the four-high, 32" Universal Slabbing Mill and the three-high 140" Sheared Plate Mill. Sections 1 and 2 housed the soaking pits and the slabbing mill respectively and were constructed about 1888. Until their demolition in 1990, they were the oldest surviving mill structures on the site. Carnegie constructed the 32" Mill with the intent to roll armor plate for the Navy. Armor for such ships as the protected cruiser *U.S.S. Olympia* was rolled on the 32" mill. It was also used as a finishing mill for forged armor such as that made for the *U.S.S. Oregon*. In 1891 the mill was converted from two-high to a four-high in order to roll thicker armor. When not rolling armor, the 32" mill was used as a slabbing mill. The remainder of the building housed the reheating ovens, mill, shear line, shipping, and boilers for the plate mill.

Constructed in 1904, the 140" Mill was a three-high Lauth mill. Obsolete with the start-up of the four-high 160" Mill, the 140" mill was considered excess capacity after the war emergency passed. It was shut down in 1945.

Until the introduction of electric mill drives at Homestead with the 110" "Liberty" Mill, each mill had its own boilers. With the electrification of the Structural Mill in the mid 1920s and the shut down of the 140" Mill, the boilers in the 140" Mill Building provided steam at 150 psi for the entire section of the plant upstream from City Farm Lane. Users of this steam included Press Shop No. 1 and the 48" Mill. At some point, the boilers were removed and equipment was installed to reduce the high pressure steam produced by boilers at Open Hearth No. 5 to the 150 psi of the older equipment.

<u>Sources</u>:

Ames, H. Clifton. Utilities, USS/Kobe Steel. Interviewed by author, May 11, 1990.

<u>Armor Plate Heat Book</u>. Cruiser Olympia Association Archives,

Penn's Landing, Philadelphia.

Carnegie Steel Corp. Rolling Mills, 1945. Collection of PHLF.

Gaughan, William J. "Chronology — Homestead Works." Tms., n.d. Annandale Archives, USX Corporation, Room 16, Sec. 380, Shelf 1, Box 7).

Jenkins, William. Power and Fuel, Homestead Works. Interviewed by author, January 9, 1990.

Making (1920, 2nd impression), 385-390, 423-427.

Sanborn, Homestead, 1901.

Historic Name: U.S. Steel, Homestead Works, Main Roll Shop
Present Name: Park Corporation, Homestead Works, Main Roll Shop
Location: Munhall, Allegheny County, PA
Construction: ca. 1895, 1925
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The Main Roll Shop is a steel frame building with brick infill consisting of a main bay flanked by two side bays and a semi-detached office with exterior dimensions of 300' long x 120' wide x 65' high. The foundations are concrete and the floor is woodblock. The main bay has pin-connected Fink trusses with knee bracing, a monitor with fiberglass panels, corrugated metal roof over wood rafters, and a glazed clerestory on the south. The south bay has riveted sawtooth Fink trusses (with one truss replaced with a Pratt), roof ventilators, bricked in windows on the south wall, a glazed clerestory. The north bay has riveted Fink trusses with a north facing sawtooth gable, a clerestory with fiberglass panels on the north, and filled in windows below. A one-story buff brick office building with basement is attached to the west end of the north bay. Roughly square, the two by two bay building has recessed horizontal brick panels above and below double hung windows. The basement contains metal templates for structural rolls.

Equipment in central bay, north side east to west, includes: A Mackintosh-Hemphill 60" heavy duty centerless contour lathe (1950s); Lathe #18 (electric motor turned one roll while brackets held a second above); Lathe #10, and Lathe #16 are the same as #18; Lathe #9, American Sheet and Tin Plate Co., Canton Ohio; Lathe #7 and Lathe #2 are the same as Lathe #9.

Equipment in central bay, south side west to east: Lathe #4, Trethewey Mfg. Co., Pittsburgh; Lathe #3, American Sheet and Tin Plate Co., last patent date: 1909; Lathe #11, Trethewey Mfg. Co., Pittsburgh, last patent date: 1906; Lathe #12, Lathe #8, Trethewey; Lathe #15, Trethewey; Lathe #13, Trethewey. All lathes use carbide tipped cutting tools.

Equipment in south bay: #2 Grinding Lathe, Farrel Foundry and Machine, Buffalo NY; Vertical Roll Grinder; 12" sandstone grinder, two stone wheels; surface grinder; Hammond 14" carbide tool grinder(s); Hammond 6" carbide tool grinder; Edge machining tool, Gould and Eberhardt, Newark, New Jersey, cast on the housing and Match and Merryweather Machinery Co., Cleveland, Ohio, on a plaque; 24" lathe: Lodge and Shipley, Cincinnati, Ohio, cast on the housing; Woodward and Powell planner; Drill press, Mueller Machine Tool Co., Cincinnati, Ohio

North bay: roll storage racks, rest/locker room above which is an office.

HISTORY

Before 1925, this was the site of the General Machine and Narrow Gage Locomotive Repair Shops. In 1925, the existing roll shop had to be torn down to make way for the new structural mill. As a consequence, the General Machine Shop was moved to its current location in the "Big Shop". The roll shop was moved into the former General Machine Shop. The riveted trusses in the north and south bays suggest that they were probably rebuilt at this time. The building was demolished in 1990.

<u>Sources</u>:

"Homestead Repair Shops Are Interesting." <u>Iron Trade Review</u> 56 (April 1, 1915): 659-65.

U.S. Steel Drawing: W-153 (1924, rev. 1925); W-158 (1925); W-170 (1925, rev. 1952).

"U.S. Steel Installs Electronically-operated Contour Roll Lathe at Homestead." <u>Iron and Steel Engineer</u> 30 (March 1953): 173-74.

<u>Historic Name</u>: U.S. Steel, Homestead Works, Water Tower
<u>Present Name</u>: Park Corporation, Homestead Works, Water Tower
<u>Location</u>: Munhall, Allegheny County, PA
<u>Construction</u>: 1893, ca. 1912
<u>Documentation</u>: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The Water Tower is an open top tank constructed of ten horizontal bands of riveted plates 50' high and 40' in diameter resting on a 22½' high octagonal brick base. The two top bands of the tank have aged differently than the others and are probably a later addition. The base has recessed corbelled panels and arched doors in four of the eight sides. A stairway with five flights gives access to the top of the tank.

HISTORY

The current Water Tower was constructed in 1893 and replaced the water tower located about 100' upstream at the time of the Pinkerton Landing in July 1892. A ca. 1895 photograph shows the tank with only eight bands (about 40' high) and is accompanied by a caption that reads: "This tank has the capacity of 200,000 gallons. This tank filled with water will be required to temper one single armor plate." Engineering drawings show that the tank was connected to the plant water system and was not solely for the Armor Plate Department. The top most bands were added ca. 1912.

There is no question that the current structure dates after the 1892 strike. The property schedule of the Homestead Works prepared in 1886 for formation of Carnegie, Phipps and Co. has the following description:

> Through these pumps the water is forced from the river through pipes into two wooden tanks, of the capacity of thirty-nine thousand (3900) gallons, from which point the water is distributed through and about said works. The two tanks are supported by a wooden frame, erected on stone foundations.

A comparison of this description with the cover of Harper's Weekly of July 16, 1892 show that the structures described in 1886 were still standing at the time of the strike. Allowing for the varying skills of the newspaper artists and artistic considerations, this description of the water tower is, of course, very different from the existing steel plate water tower with its octagonal brick base. Another factor to consider was that the Harvey shop, a major user of water, was not erected until 1893. Also, drawing number R-46, dated October 2, 1893, "Foundation for Water Tank," shows an octagonal base 41'-6" across with panels recessed into load-bearing brick walls.

Sources:
Articles of Association, Carnegie, Phipps and Co., Limited.

Recorder of Deeds Office, County of Allegheny, Limited Partnership Book, vol. 4, p. 260.

Views in Homestead Steel Works. Pittsburgh: Carnegie Steel Company, 1895. Collection of the Homestead Public Library.

U.S. Steel Drawings R-46 (1893), R-167 (1893, rev. 1912).

Historic Name: U.S. Steel, Homestead Works, Roll Storage Shop
Present Name: Park Corporation, Homestead Works, Roll Storage Shop
Location: Munhall, Allegheny County, PA
Construction: 1926
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

Spare structural mill rolls were stored in this 131' long x 47' wide x 55' high steel-frame building. The riveted-steel roof trusses are a variation on the Howe truss and have a monitor. Occasional sections of brick wall rest on the concrete foundations, but the entire structure is clad in corrugated metal. Except for a narrow gauge rail-spur used by a wood lined rail car, the interior is filled with a steel roll-storage rack.

HISTORY

The building was constructed in 1926 as part of the general modernization of the Structural Mills. The new Structural Mill combined the capacity and product lines of Homestead's existing blooming and structural mills and added wide-flange beams. Despite extensive roll storage in the mill building and the Main Roll Shop, the new mill required the construction of the Roll Storage Shop.

Source:
FM-100 Part 1-C (1965, 1980).

Historic Name: U.S. Steel, Homestead Works, Soda Ash Storage Building
Present Name: Park Corporation, Homestead Works, Soda Ash Storage Building
Location: Munhall, Allegheny County, PA
Construction: 1918
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

This one-and-a-half story brick building is about 42' x 26'. Two corners are beveled. The bevel closest to the adjacent Pump House No. 1 permits a rail line to pass. Structural beams support a half-gable corrugated metal roof with wood sheathing. A row of columns divides the interior longitudinally with a soda ash mixing trough and a stairwell in one side and a service monorail in the other.

HISTORY

Very little is known about this structure. Soda ash was mixed in the troughs to condition acidic river water for use in the plants many boilers.

Source:
U.S. Steel Drawings: R-250 (1918), FM-100 Part 1-C (1966, 1980).

Historic Name: U.S. Steel, Homestead Works, Ambulance Garage or Store Room
Present Name: Park Corporation, Homestead Works, Ambulance Garage or Store Room
Location: Munhall, Allegheny County, PA
Construction: 1910, 1920
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

This one-story brick building with corbelled eaves has two individually gabled sections with overall dimensions of 27' x 24'.

HISTORY

Very little is known about this structure. The building is labeled Ambulance Garage on a 1945 map, and Store Room on a 1965 map. Photographs taken during the 1892 Strike show another structure in this area that may have been the building marked as a laboratory in the 1906 site map.

Sources:
Carnegie Steel Corp. Rolling Mills, 1945. Collection of PHLF.

U.S. Steel Drawing: FM-100 part 1-C (1965, 1980); CE-3683-Pa (1965); G-1816 (1906).

Historic Name: U.S. Steel, Homestead Works, Pump House No. 1
Present Name: Park Corporation, Homestead Works, Pump House No. 1
Location: Munhall, Allegheny County, PA
Construction: 1891, 1896, 1912, 1914, 1921, 1923, 1943
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

River Pump House No. 1 is composed of five sections whose overall dimensions are about 150' x 40'. Foundations are all that remain of an additional two sections. The original 1891 Pump House is the three bay, one-story, brick section in the middle of the complex. A riveted Fink truss with the vestiges of a monitor replaced the original timber and tie-rod Howe truss. Doors and windows have been blocked or altered from the original arrangement of a wide segmental arched doorway in a corbelled recess flanked by similar corbelled panels with two narrow arched windows. Similar types of alteration were made to its slightly later twin immediately upstream from the original building. When the addition was built, one of the four narrow round arched windows of the southeast wall was converted to a doorway. Another of these windows has been blocked. The ruined foundations of two lean-tos built in 1912 and 1914 to house two 20 million gallon pumps are immediately upstream of the second addition.

A one-story brick and wood comfort station/office was built in 1921 on the site of the boiler house that once provided steam to operate the pumps. A two-story, 17' x 20' brick transformer building was built in 1923 and expanded in 1943. Pumping equipment in the basement includes: two Wilson-Snyder pumps missing motors; a Layne & Bowler sump pump; an unidentified pump powered by a GE motor and a Worthington motor powering two pumps. A barometric condenser that once condensed steam for steam-powered pumps stands on the upstream end of the building. In 1972 the Pump House pumped an average 17,740 gpm.

HISTORY

An unexecuted 1890 drawing for the Pump House shows a two-story brick pump house with steam pumps in the basement, boilers on the first floor and a water tank on the second floor. When actually constructed, the boiler plant was installed in a separate wood-siding building immediately downstream from the 1891 Pump House.

The oldest part of Pump House No. 1 preserves the only fabric or artifact known to survive from the 1892 Pinkerton Landing Site. According to the July 7, 1892 issue of the Pittsburgh Post,

> In the pumping station of the steel works had congregated many strikers who shot at the Pinkertons through the windows. This building is of brick and about 50 by 75 feet in area. In a deep pit are the pumps and engines. The pit is several feet smaller than the upper or brick part, leaving a narrow shelf all the way around, but a few feet below the window. Upon this the men stood. It was here that John Morris, Welshman, met his death. He stood looking out of a window when a bullet from a rifle in the hands of a Pinkerton struck him fairly in the forehead. With a cry of agony he fell back into the pit, a distance of fully 25 feet.

The Post's description of the Pump House corresponds with the 1891 blueprint, and Morris' death is confirmed by court testimony reported by Arthur Burgoyne. Photographs of the Pump House show the commanding view the Pump House windows offered the workers, and it is inconceivable from a tactical standpoint that the building would not have been used.

Sources:
Burgoyne, Arthur. The Homestead Strike of 1892. Pittsburgh: University of Pittsburgh Press, 1979, reprint; 1893 edition.

Carnegie Steel Company. Views in Homestead Steel Works. Pittsburgh: 1895. Collection of the Homestead Public Library.

U.S. Steel Drawings: R-1 (1890), R-26 (1891), R-221 (1914), R-293 (1923), R-353 (1942), FM-100 Part 1-C (1965, rev. 1980), P & F SK 52 (1962, rev. 1972).

Historic Name: U.S. Steel, Homestead Works, Blacksmith Shop Storage Area
Present Name: Park Corporation, Homestead Works, Blacksmith Shop Storage Area
Location: Munhall, Allegheny County, PA
Construction: early 1900s
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

This is a semi-enclosed area located underneath the Pittsburgh & Lake Erie Railroad trestle west of the Chem Lab Building. It contains numerous tools and swages hanging from racks used in the Blacksmith Shop that once stood nearby.

HISTORY

Prior to its demolition, the Blacksmith Shop stood about 25' east of this storage area. The storage area is jerry-built, with workers taking advantage of the P&LE trestle that extends through the works by constructing a metal frame below one of the trestle's plate girders. The floor of the plate-girder span thus forms the roof of the storage facility. Numerous tools used in the Blacksmith Shop were stored here.

Historic Name: U.S. Steel, Homestead Works, 30" Mill Building
Present Name: Park Corporation, Homestead Works, Central Maintenance
Location: Homestead, Allegheny County, PA
Construction: ca. 1901
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The 30" Mill Building has a steel-frame and is clad with corrugated sheet metal. Its overall dimensions are 1000' x 200' with a maximum height of 100'. Originally constructed to house a series of slab and plate mills, the complex now contains, east to west: the Car Repair Shops, Rigger, Pipe, Weld, Tin, and Boiler Shops. The shops are empty except for machinery listed below.

The Car Shop, which repaired overhead cranes and railroad buggies, occupied three bays: 1) Fink with monitor, 2) simple Fink and 3) Compound Fan with monitor. Outside the building on the east end is a open crane way with a Warren truss. This area once housed the soaking pits and the 30" slabbing mill.

The Rigger Shop, which has riveted Fink trusses with a louvered monitor, is the former slab shear building.

All of the Pipe Shop and part of the Weld Shops are located in five bays under one gable with a monitor as wide as the middle bay. Variations of riveted Fink trusses support the roof. Many of the structural members are single and double laced. This heavily vented area housed the slab reheating furnaces for the plate mills.

The other section of the Weld Shop has riveted Fink trusses and a monitor roof. Two electric-arc welding repair lathes remain. It is most likely that this bay is the location of the 128" sheared plate mill and the 42" universal plate mill.

A small steel-frame building with brick infill and a simple steel truss, houses an electric substation. Constructed about 1914, the building housed a turbo-generator powered by exhaust steam from the rolling mill engines.

The Tin Shop has a riveted Fink truss with a welded plate exterior (ca. 1950), and contains a circular metal saw and a spot welder.

The Boiler Shop is located in two parallel bays under a single riveted Fink truss with monitor roof. The machinery includes: bending rolls for plate up to 1¼" thick and 10' wide, vertical and horizontal rivet punches, several fabrication beds/plates, a small hydraulic straightening press and flame cutting beds. These two bays served as both the shear and shipping buildings.

HISTORY

The 30" Mill Building was built about 1901 to house plate mills purchased from the Bethlehem Iron Co. (later Bethlehem Steel) in 1897-98. Along with the Howard Axle Works (see Overview), the 30" Mill Building represents the first expansion of the mill below City Farm Lane. The plate mills included a 30" universal slabbing mill, a 42" universal plate mill, and a three-high 128" sheared-plate mill. The 128" was converted to a 118" mill in 1928 before being shut down in 1931. The 42" mill — whose production was duplicated by the 48" Mill — also shut down during the Depression. Made obsolete by the 45" Slabbing Mill, the 30" Slabbing Mill helped supply the 160" Mill during World War II. It was shut down in 1944. When the S.T.S Shop (now the Roll Processing Shop) was constructed for the Navy in 1941, it displaced several maintenance shops. These shops, as well as others, ultimately found their way into the 30" Mill Building. The Homestead water plant was once located next to the west end of the building. It was moved to a location near the Homestead High-Level Bridge during World War II to make way for Open Hearth No. 5. The complex has been demolished.

Sources:

"Homestead Repair Shops Are Interesting." Iron Trade Review 56 (April 1, 1915): 659-65.

Hornak, Raymond. Superintendent of the Homestead Structural Mill, 1978-1983. Interviewed by author, March 12, 1990.

Gaughan, William J. Chronology - Homestead Works. Tms., n.d. Annandale Archives, USX Corporation, Room 16, Section 380, Shelf 1, Box 7.

"Removal of the Bethlehem Plate Mill." Iron Age 63 (January 12, 1899): 18.

Historic Name: U.S. Steel, Homestead Works, No. 1 Slab Conditioning Yard
Present Name: Park Corporation, Homestead Works, Maintenance Garage
Location: Homestead, Allegheny County, PA
Construction: ca. 1942
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

This steel frame building measures 340' x 106' and may be as tall as 75'. It has a riveted-steel hybrid truss and monitor roof. The building has a concrete floor and is clad and roofed with corrugated metal.

HISTORY

When originally constructed for the Defense Plant as the No. 1 Slab Conditioning Yard, this building had an open crane runway extending 380' to the southwest. Unlike most large buildings in the Homestead Works, the No. 1 Slab Conditioning Yard was designed by in-house engineers and not by Keystone Bridge or American Bridge. The building had slab scarfing beds and pickling vats. Slabs rolled on the adjacent 30" slabbing mill were prepared for the 100" and 160" Mills. The building became part of Central Maintenance no later than 1973 and now serves as an automobile and truck garage.

Sources:

Hornak, Raymond. Superintendent of the Homestead Structural Mill, 1978-1983. Interviewed by author, March 12, 1990.

Plancor.

U.S. Steel Drawings: HO-G-1656 (1943, rev. 1947), PD-221 (n.d., rev. 1973, FM-100 Part II (1957, rev. 1980).

Historic Name: U.S. Steel, Homestead Works, Pump House No. 2
Present Name: Park Corporation, Homestead Works, Pump House No. 2
Location: Homestead, Allegheny County, PA
Construction: ca. 1943
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The 158' x 80' No. 2 Pump House is a 36' high steel-frame building with brick infill. The pumps are located in a deep basement. The main pump room has riveted Howe trusses and ventilators. Water-treatment facilities are located in a three-story side-bay and in four separate free-standing structures. Machinery includes four intake screens, four 1225 hp electric motors turning four 2430 gpm centripetal pumps, three water strainers about 6' in diameter, two horizontal two-stage 100 psig air compressors, four water softener tanks, seven coal water filters, numerous small electric and steam powered pumps for the water treatment facilities, a feed water heater, and five batch chemical mixing tanks. The free standing structures include a liming tower and a sedimentation tank. Upstream of the Pump House is a 22' x 47' two-story brick building with a loading dock, parts storage, and a second story office. Originally an acetylene generating plant, the building was last used by the Power and Fuel Department. In 1963-64 Pump House No. 2 pumped an average of 79,800 gpm, or 115 million gallons per day. Capacity is approximately 120 million gallons per day.

HISTORY

The No. 2 Pump House was built by the Defense Plant Corporation to supply conditioned water to Open Hearth No. 5 boilers, the water spays and flumes of the 45" and 160" mills. The complex does not appear to have undergone significant change. The building was demolished in 1991.

Source:
U.S. Steel Drawings: FM-100 Part II (1957, 1980), [no number] "Main Service Water Piping, Homestead Works," (1962, rev. 1972).

Historic Name: U.S. Steel, Homestead Works, Pump House No. 3
Present Name: Park Corporation, Homestead Works, Pump House No. 3
Location: West Homestead, Allegheny County, PA
Construction: ca. 1900, 1916, 1943

Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

Pump House No. 3 is comprised of a cluster of small buildings including the one-story 24' x 24' steel frame Pump House, a screen house and a transformer building. The pumps are located in a 25' deep, 20' diameter, brick-lined basement. At the time of the survey, parts of two pumps and the foundation of a third remained, one of which was probably steam powered. Brassert manufactured the two water strainers. Above the Pump House is a steel framework which once supported a water tank. The adjacent transformer building has a steel-frame with asphalt and asbestos covered corrugated metal siding. Capacity of the pump house in 1972 was 18,700 gpm.

HISTORY

Pump House No. 3 may have been built in conjunction with the Howard Axle Works, but undoubtedly supplied the 110" Mill and was expanded somewhat during World War II. By the 1970s, if not before, the Pump House was relegated to standby service.

Sources:
Sanborn Map Company, Homestead, 1901.

U.S. Steel Drawings: FM-100 Part III (1945, rev. 1980), P & F SK-52 (1962, rev. 1972).

Historic Name: U.S. Steel, Homestead Works, Fabricating Shop
Present Name: Park Corporation, Homestead Works, Fabricating Shop
Location: Homestead, Allegheny County, PA
Construction: ca. 1916, 1942, 1944
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The Fabricating Shop is a 55' high building composed of two bays measuring 830'x 80' and 420' x 70' (including extensions of 320' and 100' respectively). The original section of the Fabricating Shop is a brick-clad steel-frame building with long-span subdivided Pratt trusses with seven skylights running across 2/3 the width of the bays. Shallow pilasters flank horizontal brick panels above and below two horizontal ranks of shuttered windows. A third bay, now clad in corrugated metal, was removed from the southeast side and rebuilt as a 320' extension of the bay closest to the Monongahela River in 1942. A 100' corrugated-metal clad addition was added to the second bay in 1944. A one-story office and locker room building is attached to the downstream end.

Machinery in the Fabricating Shop includes: an angle shear; a thermal arc welder; a beam slitter manufactured by Birdsboro; a Birdsboro gag press; a traveling arc welder and an overhead gantry crane; a United Engineering gag press; a cold roll straightener manufactured by Lloyd Booth Co., Youngstown, Ohio (formerly at the Clairton Works); a brake press; a Cleveland Punch and Shear Works clip punch; a Long and Allstetter Co. punch; a numerically controlled beam punch manufactured by Beatty Machine and Mfg Co., Hamilton, Indiana; a Hilles and Jones Co. punch, Wilmington, Delaware; a Linco traveling welder; an unidentified punch; burning beds; a Linde acetylene torch for cutting holes; and several portable punches. The building also contains numerous rivet heaters. A display demonstrating the safe way to move the various sections and plates used in the shop is located on the wall that separates the offices and lockers from the shop floor.

HISTORY

When the mill was shut down, the Fabricating Shop was splitting structural beams for tees and did limited structural fabrication as a customer service. The building was originally constructed in 1915 to manufacture railroad ties. In 1918 the site was briefly considered for the Slick Wheel Works. The Fabricating Shop was moved to the building from its location adjacent to the 40" Blooming and the 35" Finishing Mills (approximately where the No. 1 Structural Line was built) when the Structural Mills were modernized in 1925. The southeast bay had to be moved in 1942 to accommodate vehicular traffic when the adjacent 160" Mill Building was constructed by the Defense Plant.

Sources:

"Homestead Repair Shops Are Interesting." Iron Trade Review 56 (April 1, 1915): 659-65.

Hornak, Raymond. Superintendent of the Homestead Structural Mill, 1978-1983. Interviewed by author, March 12, 1990.

U.S. Steel Drawings: FM-100 Part II (1957, 1980), J-27 (1915, 1917), J-18 (1915), J-53 (1915), J-322 (1918), J-629 (1942, rev. 1969).

Historic Name: U.S. Steel, Homestead Works, Open Hearth No. 4 Trestle
Present Name: Park Corporation, Homestead Works, Open Hearth No. 4 Trestle
Location: Munhall, Allegheny County, PA
Construction: ca. 1906
Documentation: Photographs of the Auxiliary Buildings can be found in HAER No. PA-200-P.

DESCRIPTION

The Trestle is a steel and concrete structure about 1500' long that divides the 19th century section of the plant from the 20th century expansions. Running almost the entire length of the east side of City Farm Lane, the trestle is constructed of structural steel except between Eighth Avenue and the Pennsylvania Railroad tracks where it is concrete. The concrete section has a flat facade with two arched openings to the interior of the mill. On the mill side, deep arches which do not penetrate the full width of the concrete trestle section support the track.

HISTORY

The Trestle was constructed to supply the charging floor of Open Hearth No. 4. The arch closest to Eighth Avenue is called the Hole in the Wall by the steel workers because they passed through it to get their pay at the paymaster's station located near Open Hearth No. 4.

APPENDIX II - SELECTED BIBLIOGRAPHY

SELECTED BIBLIOGRAPHY

*organized chronologically

1875-1899:

"Manufacturing: Iron and Steel." Iron Age 53(February 22, 1894): 372.
Electric cranes at Homestead are "rapidly displacing many Hungarian Laborers, and they are leaving that place in large numbers for other points."

"Manufacturing: Iron and Steel." Iron Age 53(March 1, 1894): 422.
Old 28" mill to be torn down and replaced with electric mill. Three steam cranes at riverbank to handle coal and sand from barges.

"Manufacturing: Iron and Steel." Iron Age 53(March 22, 1894): 561.
Ground was broken for construction of Homestead's new 28" blooming mill.

"Manufacturing: Iron and Steel." Iron Age 53(March 29, 1894): 618.
A 10,000-ton British press imported for Homestead Armor Plate Department recently put in operation.

"Manufacturing: Iron and Steel." Iron Age 53(May 3, 1894): 852.
The new 28" mill now completed and will be tested. Mill will displace 14 men on 2 turns: 1 pull-around, 2 tongsmen, 2 cover pullers, 2 on stocking gang.

"Manufacturing: Iron and Steel." Iron Age 53(May 10, 1894): 901.
New 28" put into full operation last week.

"The Armor Plate Report." Iron Age 54(August 30, 1894): 342-43.
House Committee investigation of substandard armor plate supplied to U.S. Navy by Homestead Works. Article includes some production process details.

"Manufacturing: Iron and Steel." Iron Age 54(October 11, 1894): 621.
Open hearth No.1 to be remodeled with electric cranes and charger. Ingots to be cast on buggies rather than in pits.

"Manufacturing: Iron and Steel." Iron Age 54(November 1, 1894): 760.
Attempts to roll street car rails on the 35" mill were not successful.

"Manufacturing: Iron and Steel." Iron Age (April 9, 1896): 878.
Carnegie Co. to replace Homestead Bessemer with 16 basic open hearths. Total number will be 36, ranging from 12 to 50 tons in capacity.

Crooker, Ralph Jr. "The Development of the American Blooming Mill." Proceedings of Engineers' Society of Western Pennsylvania 13(1897): 325-39; discussion 339-46.
Description and discussion of 1881 Homestead blooming mill with first U.S.-built rolling mill reversing engine designed by James Hemphill.

"The Hilles & Jones Hot Plate Straightening Machine." Iron Age 64(October 19, 1899): 8.
Describes straightening rolls installed at Homestead.

"Manufacturing: Iron and Steel." Iron Age 64(November 16, 1899): 23.
A 108" mill brought from Bethlehem Steel in early part of year to be tested next week. The 44" mill will be operable about first of next year.

1900-1909:

Monell, Ambrose. "The Production of Basic Open Hearth Steel from Pig and Ore." Iron Age 65(May 31, 1900): 16-17.
Article describes molten pig-and-ore process introduced at Homestead's two 40-ton furnaces in February.

"The Carnegie Company Steel Bridge at Rankin." Iron Age 66 (October 4, 1900): 14.
Gives specifications of the hot metal bridge crossing Monongahela River from Carrie Furnaces to Homestead

"The Howard Axle Works." Iron Age 66(October 4, 1900): 7.
New Homestead rolling mill started with novel axle rolling and forging process. Output sold chiefly to Pressed Steel Car Co.

"A Large Gas Engine and Electric Power Plant." Iron Age 66 (November 1, 1900): 14-16.
Article describes 650 hp. Westinghouse gas engine connected to DC generator at Howard Axle Works. Describes application to machine shop tools.

"The Homestead 48" Universal Plate Mill." Iron Age 66 (December 27, 1900): 1-2, 3, 4, 5.
Illustrated description of heating furnaces, mill, hot bed, shears, cranes, boiler plant, and mill engines. Mill began operating July 18.

"The Monell Open Hearth Patent." Iron Age 67(January 3, 1901): 54.
General description of patented process developed by Homestead's Ambrose Monell.

"The Carrie Group of Furnaces." Iron Trade Review 36(January 17, 1901): 6.
Description of plans to demolish Furnace No.2 and replace it with a 105' x 20' furnace. The second-oldest furnace will also be torn down and rebuilt.

"A Plate Mill Record." Iron Age 67(January 31, 1901): 39.
Description of output at Homestead's 128" mill.

"Improvements at Homestead." Iron Age 67(February 14, 1901): 33.
Announcement of 4 addition open hearths in No. 2 Shop plus new roll shop annex and pipe fitting shop.

"The New Carrie Furnaces." Iron Age 67(March 7, 1901): 11.
Describes 2 new 105' x 33' furnaces with 600-700 tons per day output plus the nearly-completed hot metal bridge.

"Increased Furnace Capacity for U.S. Steel." Iron Trade Review 34(May 9, 1901): 18.
Overview article concerning Carrie furnaces.

"The Howard Axle Works of the Carnegie Steel Company." Iron Age 67(June 13, 1901): 10-13.
Illustrated description of plant for rolling billets from Homestead to approximate size then finishing by forging.

"Howard Axle Works at Homestead." Iron Trade Review 34(June 13, 1901): 19-20.
Companion article to entry above.

"The Monnell Process." Iron Age 67(June 27, 1901): 33.

"The Carrie Furnaces." Iron Age 68(September 19, 1901): 20-21.
Describes rebuilding blast furnaces No. 1 and 2 to achieve 400-ton capacity.

"Continuous Rolling of Beams." Iron Trade Review 34(September 26, 1901): 23.
Homestead experiments with using horizontal and vertical rolls on beams. Success will yield a new mill.

"World's Pig Iron Record Beaten." Iron Age 68(November 28, 1901): 33.

The No. 3 Carrie blast furnace produced 790 tons of basic iron in 24 hours, beating Duquesne by 59 tons.

"New Blast Furnaces at Youngstown and Pittsburgh." Iron Age 69(June 5, 1902): 47.
Carnegie announces plans to build fifth blast furnace at Carrie. It will be 105' high x 22' diameter, yielding 600 tons per day.

"The No.4 Open Hearth Plant at Homestead Started." Iron Age 78(July 12, 1906): 98.

Woodworth, R.B. "New Forms of Steel for New Uses." Iron Age 81(March 12, 1908): 838-43.
Review of Homestead rolling standards for beams set in 1888, 1889, and 1897.

"A New Blast Furnace Igniter." Iron Age 82(September 17, 1908): 786.
Describes electric arc igniter replacing hot rods used at blowing-in of Carrie No. 2 furnace.

1910-1919:

"New Iron and Steel Works Construction." Iron Age 85(January 6, 1910): 4-7.
Notes changes in Homestead's changes in the 35" and 40" structural mills and the enlargement of Carrie Furnaces' electrical plant.

"Carnegie Steel Company Improvements." Iron Age 89(June 20, 1912): 1523.
Cites Homestead's remodeled 10" mill with addition of two 14" roughing stands to improve rolling of forging steels used in drop forges and for auto parts.

"Vanadium Shear Knife." Iron Trade Review 54(March 5, 1914): 471.
Homestead employs vanadium steel knife as bottom blade of armor plate department shear. Knife installed November 14, 1913 to cut scrap.

"Homestead Repair Shops Are Interesting." Iron Trade Review 56(April 1, 1915): 659-65.
Cites distinctions in equipment, tools, and work processes at Homestead/Carrie repair, machine, and woodworking shops.

Soderberg, A. W. "Apprentice School." Iron Trade Review 56(June 10, 1915): 1169-70.
Account of Homestead's welfare programs with focus on apprentice training school.

"The Liberty Mill of the Carnegie Steel Co." Iron Age 101(January 3, 1918): 18-22.
Illustrated description of 110" 3-high sheared plate mill built in 6 months to supply demand of World War I. This was first electrically-driven plate mill at Carnegie.

Woodworth, R.B. "New Liberty Mill Now Makes Plates." Iron Trade Review 62(January 3, 1918): 38-39, 207-08.
Description of Carnegie's World War I 110" plate mill at Homestead. Companion to article above.

Mohr, Jacob A. "Methods of Charging Raw Materials into the Blast Furnace." American Iron and Steel Institute Yearbook (1919): 231-56.
Includes discussion of recent improvements in coke screens, larry cars, skip cars, and stock distributing machinery for stationary tops at Carrie Furnaces.

Mohr, Jacob A. "Methods of Charging Blast Furnaces." Iron Trade Review 64(May 29, 1919): n.p.
Author, Superintendent of Carrie furnaces, discusses blast furnace practices including adjustments in charging air, screening coke, and combining materials in furnace charges.

1920-1929:

Toy, Francis L. "The Basic Open-Hearth Process." American Iron and Steel Institute Yearbook (1920): 319-62.
Extensive technical article and historical review of Lash furnace with horizontal flue checkers and natural gas firing used in first commercial production at Homestead, 1888.

Bulmer, William C. "Gas and Air Valves for Open-Hearth Furnaces." American Iron and Steel Institute Yearbook (1922): 221.
Includes brief illustrated discussion of water-cooled butterfly valve and McConnell air reversing valve used at the No. 2 open hearth at Homestead.

Bulmer, William C. "Valves for Open-Hearth Furnaces." Iron Age 109(June 1, 1922): 1556-57.
Companion discussion of 1889 butterfly valve and double-seated mushroom valve used at No. 2 open hearth at Homestead.

"Build Two Open Hearths." Iron Trade Review 72(March 1, 1923): 637.
Foundations laid for two 100-ton open hearth furnaces at Homestead Works. These units will be smallest of current 14 open hearths.

"Will Modernize Plant." Iron Age 113(January 24, 1924): 310.
Carnegie Steel to spend $ 20 million over 3-4 years for structural mills at Homestead.

"New Homestead Structural Mills Are to be Electrically Driven." Iron Age 113(May 29, 1924): 1578.
Homestead 44" blooming mill and 36/28-32" structural mill will replace three steam-powered structural mills. Turbo generators will be installed at Carrie Furnaces.

"Rolling Mill Awards." Iron Age 114(September 11, 1924): 630.
Mesta Machine to furnish 36" mill for Homestead.

Bailey, W. H. "Blooming Mills and Blooming Mill Practice." American Iron and Steel Institute Yearbook (1925): 26-76.
Excellent comparative descriptions of mill construction, equipment, and operations. Particular attention given Homestead's 44", 2-high reversing bloomer. With diagrams.

Biggert, F.C. Jr. "Discussion." American Iron and Steel Institute Yearbook (1925): 76-81.
Follow-up to Bailey. Biggert's United Engineering & Foundry Co., built the Homestead 44" blooming mill he describes in detail.

Needham, O. "Discussion" American Iron and Steel Institute Yearbook (1925): 81-84.
Follow-up to Biggert article. Needham of Westinghouse Electric installed the 7000 hp. single armature motor driving the blooming mill apparatus.

"Builds World's Largest Blooming Mill." Iron Trade Review 76(May 7, 1925): 1205.
Homestead acquiring a 54" blooming mill, largest ever built, for structural plant. It will be used with two 52" beam mills. A 44" blooming mill is nearly finished.

"Carnegie Steel Lets First Unit for Its New `H' Beam Mill." Iron Age 115(May 21, 1925): 1502.

Bailey, W. H. "Designing and Operating Blooming Mills." Iron Trade Review 76(May 28, 1925): 1390-91.
Comparison of blooming mill: Gary billet mill vs. 44" two-high reversing bloomer at Homestead and 40" at Weirton.

"Notable Blooming Mill." Iron Age 116(July 30, 1925): 271, 320.
Describes 44" two-high reversing blooming mill at Homestead emphasizing one-step roll and bearing removal operation.

"$3.80 Less Per Ton Than in 1924." Iron Age 117(March 25, 1926):

845-48.
The Homestead 33", 38", and 40" blooming mills being dismantled and replaced with one 44" blooming mill.

"Blooming Mill of Massive Size." Iron Age 118(August 5, 1926): 348-50.
Illustrated description of 54" two-high reversing blooming mill for Homestead.

"How Electric Traveling Crane Came." Iron Age 118(August 26, 1926): 541-43; and (September 9, 1926): 722.
Homestead was first big steel plant to use electric cranes: 13 10-ton cranes added 1893.

"Blast Furnace Development." Iron Age 118(September 30, 1926): 943.
Superintendent of Carrie Furnaces, James E. Lose, discusses behavior of blast furnaces with large (21'+) hearths.

Lose, James E. "The Operation of Large Hearth Furnaces Using Coke Made from One Hundred Per Cent High Volatile Coal." American Iron and Steel Institute Yearbook (1927): 79-102.
Elaborate discussion of high productivity gains in large-hearth blast furnaces. Special reference to Carrie furnaces 1, 2, 6, and 7.

"New Carnegie Structural Beams." Iron Age 119(February 17, 1927): 505.
Homestead to roll wide-flange beams in new structural mill. Carnegie beams differ from Bethlehem Gray beam in uniform flange thickness.

Menk, C. A. "New Homestead Structural Mills." Iron Age 119(June 23, 1927): 1815-16.
Describes two groups of structural mills: 44"blooming/36" roughing/28-32" finishing for standard structural steel and 54" blooming/52" structural for wide-flange beams.

"Judge Gary Starts Steel Mills with Wave of Hand." Iron Trade Review 80(June 23, 1927): 1598.
U.S. Steel Chairman Gary's theatrical move to generate electric signal in New York City powering new rolling mill motors in Homestead.

"Tell Story of Steel Mill Electrification in 1926." Iron Trade Review 80(June 23, 1927): 1597-99.
Homestead's use of electric drive for new blooming, roughing, and finishing mills is described.

Koon, Sidney D. "Mill to Roll New Carnegie Beams." Iron Age

121(May 17, 1928): 1380-85.
Illustrated description of 54" and 52" mills for rolling new H-beams. Mills featured limit switched to control screw-down devices on roughing and intermediate stands in the 52".

"Swiveling Crane of Unusual Type." Iron Age 121(June 7, 1928): 1613-14.
Overhead traveling cranes with 10-ton hoist at each end of swiveling beam used to turn beams 90 degrees in Homestead's structural mills shipping yard.

1930-1939:

"Carnegie Will Improve Homestead Works." Steel 89(November 2, 1931).
New construction at Homestead. Works has 65 open hearth furnaces with 2.6 million ton capacity now.

"Carnegie Plate Mill Will Cover Area of 9 1/2 Acres." Steel 97(August 19, 1935): 15.
Description of proposed 100" continuous electric-drive plate mill to be located between the 110" Liberty Mill and the Pittsburgh & Lake Erie Railroad tracks.

"Carnegie Plate Mill." Blast Furnace and Steel Plant 23 (September 1935): 609.
Notes that first Homestead plate mill, the 119", was put in operation February 19, 1887.

"Carnegie Plate Mill Described." Blast Furnace and Steel Plant 23(September 1935): 650-51.
Brief notice of new semi-continuous 100" sheared plate mill to be erected at Homestead.

"Carnegie-Illinois Steel Orders Pressure meters." Iron Age 137 (June 25, 1936): 94.
Homestead's 100" plate mill to have United Engineering & Foundry Co. instrumentation that provides continuous indications of rolling loads on all major stands.

"Announce $60,000,000 Expansion at $10,000,000-Mill Dedication." Steel 100(January 18, 1937): 19.
The formal dedication of Homestead's 100" plate mill detailed with components and innovations listed. Plans for expansion at Clairton and Edgar Thomson announced.

"Reversing Roughing Unit with Vertical Roll Edger Features Homestead Sheared Plate Mill." Steel 100(January 18, 1937): 38-43, 64.
Elaboration of components at Homestead's 100" plate mill.

"100-In. Plate Mill Combines Precision with Large Output." Blast Furnace and Steel Plant 25(February 1937): 195-200, 218, 233.
Illustrated description of new semi-continuous mill including accounts of slab reheating furnaces, bearings, motors, roller leveller, shears.

"Produces Forging Ingots That Weigh Up to 500,000 Pounds." Steel 105(July 31, 1939): n.p.
Massive forging ingots of up to 95" now possible at Homestead with new mold equipment. Homestead both uses and sells these pieces on a merchant basis.

1940-1949:

"Carnegie-Illinois to Build New Blast Furnace." Iron Age 145 (April 18, 1940): 80.
New furnace will replace present #3 Furnace at Carrie.

"Carnegie-Illinois Rebuilds Carrie Stack." Iron Age 146(December 19, 1940): 81.
A second blast furnace will be rebuilt to gain 1100-ton capacity.

"C-I Widens Homestead Roughing Stand to 120 In." Iron Age 147 (January 30, 1941): 78.
Reversing roughing stand on 100" plate mill widened as part of potential plate mill expansion upgrading shear, leveller, straightener, and other capacity for armor deck plate.

"$7,000,000 Armor-Plat Forging Press Working 200 Tons of Steel." Steel 108(June 23, 1941): 23.
Photo and Caption of Homestead's 12,000-ton armor-plate ingot press.

"C-I to Build Twelve 200-Ton Open Hearths." Iron Age 148(July 24, 1941): 93c.
Homestead's government-financed expansion includes 1.7 million ton steelmaking capacity, armor plate forging and machining plant, 160" plate mill for deck plate.

"Picture Story of Armor Plate." Iron Age 148(July 24, 1941): 93a-b.
Photos show heating of ingot, forging in 12,00-ton press, planing to remove surface defects, and roller levelling.

"Battleship Armor - 200-Ton Chunks of Jewelry Steel.;" Iron Age 149 (January 1, 1942): 70-71.
Photos illustrate hydraulic forging and roller levelling of belt armor plates.

"New C-I Plant Will Add 1,494,000 Ingot Tons, 413,000 Plates, Forgings." Iron Age 151(June 17, 1943): 103.
First 2 of 11 open hearths tapped. Major equipment includes 45" slabbing mill, 20 gas-fired soaking pits, 160" plate mill with 4 heating furnaces, 7500-ton forging press.

"First Steel Poured at New Homestead Works Expansion." Steel 112(June 21, 1943): 83
New open hearths mark DPC-funded wartime expansion. Company will have 1.5 million tons more ingot capacity on new 123-acre site with 80 buildings.

"Steel Tapped from Furnaces in Homestead Expansion." Blast Furnace and Steel Plant 31(July 1943): 795.
First of 11 225-ton open hearths in current expansion program tapped June 14, 1943. Furnaces designed so slag is run off from front and back simultaneously.

"Carnegie-Illinois Pittsburgh Expansion Near Completion." Iron Age 153(January 27, 1944): 92.
New 45" slab mill began operation last week. Mill has 20 15'x16' gas fired soaking pits and 1.35 million ton capacity.

"New DPC Plant Nears Completion." Steel 114(January 24, 1944): 31.
This article recounts the demolition of Homestead to create the new DPC-funded, Carnegie-owned plant expansion.

"Homestead Mill Adds Turn." Iron Age 154(September 14, 1944): 126.
160" plate mill adds 2nd turn but operational and mechanical difficulties still inhibit maximum production.

Ericson, A. G. "Universal Slabbing Mill Will Roll All Grades of Steel Including Stainless and Alloy." Blast Furnace and Steel Plant 33(January 1945): 111-13.
Illustrated description of 45" x 80" mill erected for Defense Plant Corporation at Homestead. Features roller bearings, combined wet/dry scale disposal, and gas scarfing machine.

Ericson, A. G. "Universal Slabbing Mill Differs from Most Designs." Steel 116(January 8, 1945): 108, 110.
Homestead's Chief Engineer describe the new 45" x 80" universal slabbing mill and explains its design characteristics.

Cramer, Frank W. "Twin-Motor Drives in Hot Reducing Mills." Iron Age 156(October 11, 1945): 58-61.

Article cites application of twin-motor drive to the 45" slabbing and 160" four-high plate mills. Twin motors maximize torque and were introduced at the Chicago South Works 1928.

Vosburgh, Frank L. "Carbon Lining for Blast Furnace: Its History, Installation, and Advantage." Steel 117(December 31, 1945): 62-62, 78, 90. Includes bibliography.
Technical discussion of use of carbon blocks in blast furnace operation as illustrated by 1944 Carrie stack relining. Illustrated with photos and diagrams.

Nolan, V. J. "Progress Report on Carbon Linings for Blast Furnaces." Blast Furnace and Steel Plant 35(April 1947): 454-60.
Includes account of carbon hearths at Carrie.

"Engineering News at a Glance: Record Slab Output." Steel 121 (July 28, 1947): 82.
Statistics on production for Homestead's 45" reversing slabbing mill.

Knox, John. "Sound Hearth Construction." Steel 121(October 20, 1947): 102, 105.
Technical assessment of blast furnace hearth bottom construction as illustrated by Carrie furnaces.

Fleisch, C. J. "Design of Carbon Hearths and the Results Obtained at the Carrie Furnace." Blast Furnace and Steel Plant 35(November 1947): 1359-60.
Describes details of hearth and tap hole construction plus operating experience with carbon vs. fireclay refractory lining.

Fleisch, C. J. "Progress Report on Blast Furnace Carbon Hearths." Steel 121(November 17, 1947): 116, 118.
Article on three carbon hearths at Carrie furnaces.

Scherer, W. W. and H.J. Ralston. "Automatic Welding of Steel Mill Equipment." Iron Age 162(July 15, 1948): 80-88.
Extensive account of automatic arc welding in repairing heavy equipment at Homestead. Procedure was first adopted in 1944.

1950-1959:

"Slabbing Mill, 63 Years Old, to Roll for Carnegie-Illinois." Iron Age 166(July 27, 1950): 79.
The 32' slabbing mill at Homestead, idle 5 months. will be operating 1 shift per day with 75-man crew.

"Four-Sided Scarfer Installed at Homestead Mill." U.S. Steel News 21(January 1956): 46.
Article notes the installation of a scarfer at the 45" mill.

"New Office Building to be Built at Homestead Works." U.S. Steel News 21(January 1956): 47.
Brief article and sketch of the new office installation.

"Something New In Furnaces at Homestead Works." U.S. Steel News 21(January 1956): 39.
Article cites installation of vertical heat treating furnaces in forging division.

"Handling: Blast Furnace Scale Car Built with New Design." Iron Age 178(July 26, 1956): 88, 92.
Self-propelling car for weighing ore, coke, and limestone charges installed at Carrie Furnace. Features include automatic recording of bin loads on tape.

"Another Step Forward for `T-1' and Stainless Steels." U.S. Steel News 22(October 1956): 23-25.
Description of Homestead's new heat-treating operation. New facility can handle plate 45" x 13" x 2" in size.

"Handling: Steel Mill Work Roll Tongs." Iron Age 178(November 8, 1956): 120.
Automatic Heppenstall scissor tongs dispense with chains or rigging in moving rolls after heat treating operations.

"Homestead Office Building Symbolizes New Market Venture." U.S. Steel News 22(January 1957): 38.

"Old Pros Roll Toward Record Finish." U.S. Steel News 23(July 1958): 18-19.
Popular essay on the men in pulpit at 45" slabbing mill.

1960-1969:

"New Heat Treating Facilities Installed at Homestead." U.S. Steel News 25(June 1960): 22.

"'Master Mixers' of the Open Hearth." U.S. Steel News 25(August 1960): 25.
Public relations piece describing the open-hearth Melter and his crew at Homestead.

"The Homestead `Smithies'." U.S. Steel News 25(October 1960): 18-19.
Popular essay on the people and operations in Homestead's forgings division.

"The Heat's on at Homestead." U.S. Steel News 26(July-August 1961): 16-17.
Photoessay on the facilities and operations of Homestead's heat-treating processes in the 160", 100", and forge divisions.

"Vacuum Carbon Deoxidizing Unit." U.S. Steel News 30(January 1965): 17.
The new 310-ton facility to reduce hydrogen-oxygen content in molten steel to yield cleaner, more ductile steel.

"Showcase of Stainless Facilities Starts Up at Homestead." U.S. Steel News 34(July-August 1969): 10-12.
Photoessay on equipment and operation of Homestead's stainless facility. Mill works to customer order using specialty manufacturing techniques and inspection methods.